HAWAII ADMINISTRATIVE RULES

TITLE 11

DEPARTMENT OF HEALTH

CHAPTER 60

AIR POLLUTION CONTROL

Subchapter 1 Prohibitions and General Requirements

Subchapter 2 Open Burning

emitted the pollutant during a two-year period which precedes the particular date and which is representative of normal source operation. The director shall allow the use of a different time period upon a determination that it is more representative of normal source operation. Actual emissions shall be calculated using the unit's actual operating hours, production rates, and types of materials processed, stored, or combusted during the selected time period;

(2) The director may presume that the source specific allowable emissions for the unit are equivalent to the actual emissions of the unit;

(3) For any emissions unit which has not begun normal operations on the particular date, actual emissions shall equal the potential to emit of the unit on that date.

"Agricultural burning" means open outdoor fires used in agricultural operations, growing of crops, raising of fowls or animals, forest management, or range improvements.

"Agricultural operation" means a bonafide agricultural activity with a license to engage in business, but shall not include school or governmental agricultural activities.

"Air pollutant" means smoke, charred paper, dust, soot, grime, carbon, noxious acids, fumes, gases, odors, particulate matter, or any combination of these.

"Air pollution" has the same meaning as in section 342-21, HRS.

"Allowable emissions" means the emissions rate of a stationary source calculated using the maximum rated capacity of the source (unless the source is subject to federally enforceable limits which restrict the operating rate, or hours of operation, or both) and the most stringent of the following:

(1) The applicable standards set forth in the Standards of Performance for New Stationary Sources or the National Emission Standards for Hazardous Air Pollutants;

(2) Any applicable federally enforceable provisions of this chapter including those with a future compliance date; or

(3) The emissions rate specified as a federally enforceable permit condition, including those with a future compliance date.

"Ambient air" means the general outdoor atmosphere.

"BTU" means British thermal unit.

"Baseline area" means any intrastate area (and every part thereof), designated as attainment or unclassifiable under the Clean Air Act in which the major stationary source or major modification establishing the baseline date would construct or would have an air quality impact equal to or greater than one ug/m^3 (annual average) of the pollutant for which the baseline date is established.

through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of that pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable Standards of Performance for New Stationary Sources and the National Emission Standards for Hazardous Air Pollutants. If the director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, or operational standard, or a combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. The standard, to the degree possible, shall set forth the emissions reduction achievable by implementation of the design, equipment, work practice, or operation and shall provide for compliance by means which achieve equivalent results.

"Building, structure, facility, or installation" means all of the pollutant-emitting activities which belong to the same industrial grouping, are located on one or more contiguous or adjacent properties, and are under the control of the same person (or persons under common control) except the activities of any vessel. Pollutant-emitting activities shall be considered as part of the same industrial grouping if they belong to the same "Major Group" (i.e., which have the same two-digit code) as described in the "Standard Industrial Classification Manual, 1972," as amended by the 1977 Supplement (U.S. Government Printing Office stock numbers 4101-0066 and 003-005-00176-0, respectively).

"Clean Air Act" means the federal Clean Air Act (42 U.S.C. 7401 et seq.) as in effect on date of adoption (MAR 25 1986).

"Commence" as applied to construction of a stationary source or modification means that the owner or operator has all necessary preconstruction approvals or permits and either has:

(1) Begun, or caused to begin a continuous program of actual on-site construction of the source, to be completed within a reasonable time; or

(2) Entered into binding agreements or contractual obligations, which cannot be cancelled or modified without substantial loss to the owner or operator, to undertake a program of actual construction of the source to be completed within a reasonable time.

"Complete" means, in reference to an application, that the application has been properly and fully answered, and timely submitted together with all fees and all required or requested information including tests, analyses, reports, maps, diagrams and other data, and that all other processing steps and requirements have been timely complied with.

"Fugitive emissions" means those emissions which could not reasonably pass through a stack, chimney, vent, or other functionally equivalent opening.

"HRS" means Hawaii Revised Statutes.

"Impact area" means the largest area in a baseline area in which a major source or major modification would have an air quality impact equal to or greater than the concentrations listed below for the pollutant for which a baseline date is established.

Sulfur dioxide	
Annual average	one ug/m^3
Twenty-four-hour average	five ug/m^3
Three-hour average	twenty-five ug/m^3
Total suspended particulate	
Annual average	one ug/m^3
Twenty-four-hour average	five ug/m^3
Nitrogen dioxide	
Annual average	one ug/m^3
Carbon monoxide	
Eight-hour average	0.5 mg/m^3
One-hour average	two mg/m^3

"Mg/m^3" means milligrams per cubic meter.

"Major modification" means any physical change in or change in the method of operation of a major stationary source that would result in a significant net emissions increase of any pollutant subject to regulation under the Clean Air Act.

(1) Any net emissions increase that is considered significant for volatile organic compounds shall be considered significant for ozone.

(2) A physical change or change in the method of operation shall not include:

(A) Routine maintenance, repair, and replacement, such that replacement does not constitute reconstruction;

(B) Use of an alternative fuel or raw material by reason of an order under sections 2(a) and (b) of the Energy Supply and Environmental Coordination Act of 1974 (15 USCS §§791 et. seq.) or by reason of a natural gas curtailment plan pursuant to the Federal Power Act (16 USCS §§791a et. seq.);

(C) Use of an alternative fuel by reason of an order or rule under the Clean Air Act;

(D) Use of an alternative fuel at a steam generating unit to the extent that the fuel is generated from municipal solid waste;

stationary source, if the changes would constitute a major stationary source by itself.

(4) A major stationary source that is major for volatile organic compounds shall be considered major for ozone.

"Modification" means any physical change to or change in the method of operation, including switching to a fuel with a higher sulfur or ash content, of a stationary source which changes the amount of any air pollutant emitted by such source or which results in the emission of any air pollutant not previously emitted.

"NAAQS" means any National Ambient Air Quality Standards contained in title 40 of the code of federal regulations, part 50 as in effect on date of adoption (MAR 25 1986).

"National Emission Standards for Hazardous Air Pollutants" means any federal emission standards contained in title 40 of the code of federal regulations, part 61 as in effect on date of adoption (MAR 25 1986).

"Necessary preconstruction approvals or permits" means those permits or approvals under federal air quality control laws and regulations, and this chapter.

"Net emissions increase" means the amount by which the sum of any increase in actual emission from a particular physical change or change in method of operation at a stationary source and any other increases and decreases in actual emissions at the source that are contemporaneous with the particular change and are otherwise creditable exceeds zero.

(1) An increase or decrease in actual emissions is contemporaneous with the increase from the particular change only if it occurs between:
   (A) The date five years before construction on the particular change commences; and
   (B) The date that the increase from the particular change occurs.

(2) An increase or decrease in actual emissions is creditable only if the director or EPA administrator has not relied on it in issuing any permit which is still in effect for the source under the prevention of significant deterioration review rules of this chapter or EPA PSD regulations when the increase in actual emissions from the particular change occurs.

(3) An increase or decrease in actual emissions of sulfur dioxide or particulate matter which occurs before the applicable baseline date is creditable only if it is required to be considered in calculating the amount of maximum allowable increases remaining available.

modification, but do not come from the major stationary source or major modification itself. For the purpose of this chapter, secondary emissions shall be specific, well defined, quantifiable, and impact the same general area as the stationary source or modification which causes the secondary emissions. Secondary emissions include emissions from any offsite support facility which would not be constructed or increase its emissions except as a result of the construction or operation of the major stationary source or major modification. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of a motor vehicle, from a train, or from a vessel.

"Significant" means:

(1) In reference to emissions of any of the following pollutants, a rate of emissions that would equal or exceed any of the following rates:

Pollutant and Emissions Rate

Carbon monoxide: one hundred tons per year (tpy)
Nitrogen oxides: forty tpy
Sulfur dioxide: forty tpy
Particulate matter: twenty-five tpy
Ozone: forty tpy of volatile organic compounds
Lead: 0.6 tpy
Asbestos: 0.007 tpy
Beryllium: 0.0004 tpy
Mercury: 0.1 tpy
Vinyl chloride: one tpy
Fluorides: three tpy
Sulfuric acid mist: seven tpy
Hydrogen sulfide (H_2S): ten tpy
Total reduced sulfur (H_2S, methyl mercaptan, dimethyl sulfide, and dimethyl disulfide): ten tpy
Reduced sulfur compounds (H_2S, carbon disulfide and carbonyl sulfide): ten tpy

(2) In reference to emissions of a pollutant subject to regulation under the Clean Air Act that paragraph (1) does not list, any emissions rate.

(3) Notwithstanding paragraph (1), any emissions rate or any net emissions increase associated with a major stationary source or major modification which would construct within ten kilometers of a class I area, and have an impact on such area equal to or greater than one ug/m^3 (twenty-four-hour average).

"Smoke" means the gaseous products of burning carbonaceous materials made visible by the presence of small particles of carbon.

§11-60-3 Visible emissions. (a) Visible emission restrictions for stationary sources which commenced construction or were in operation before March 21, 1972.

(1) No person shall cause or permit the emission of visible air pollutants of a density equal to or darker than forty per cent opacity, except as provided in paragraph (2).

(2) A person may discharge into the atmosphere from any single source of emission, for a period aggregating not more than six minutes in any sixty minutes, air pollutants of a density not darker than sixty per cent opacity when building a new fire or when breakdown of equipment occurs.

(b) Visible emission restrictions for stationary sources, the construction, modification, or relocation of which commenced after March 20, 1972.

(1) No person shall cause or permit the emission of visible air pollutants of a density equal to or darker than twenty per cent opacity, except as provided in paragraph (2).

(2) A person may discharge into the atmosphere from any single source of emission, for a period aggregating not more than six minutes in any sixty minutes, air pollutants of a density not darker than sixty per cent opacity when building a new fire or when breakdown of equipment occurs.

(c) Compliance shall be determined by procedures for evaluating actual opacity readings as described in "Guidelines for Evaluation of Visible Emission" (EPA Document No. EPA-340/1-75-007, April 1975).

(d) Exceptions for uncombined water. The provisions of subsections (a) and (b) shall not apply to any emission which, except for the presence of uncombined water, such as condensed water vapor, would not be in violation of those provisions. [Eff. November 29, 1982; am, ren §11-60-3 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-4 Control of motor vehicles. (a) No gasoline-powered motor vehicle shall be operated which emits visible smoke while upon streets, roads, and highways.

(b) No diesel-powered motor vehicle shall be operated which emits visible smoke for a period of more than five consecutive seconds while upon streets, roads, and highways.

(c) No person shall cause, suffer, or allow to keep any engine in operation while the motor vehicle is stationary at a loading zone, parking, or servicing area, route terminal, or other off street areas, except:

(5) Conduct of agricultural operations such as tilling of land, application of fertilizers, etc. in such manner as to minimize airborne dust;
(6) The paving of roadways and their maintenance in a clean condition; and
(7) The prompt removal of earth or other material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water, or other means.

(b) Except for persons engaged in agricultural operations or persons who can demonstrate to the director that best practical operation or treatment is being implemented, no person shall cause or permit the discharge of visible emissions of fugitive dust beyond the lot line of the property on which the emissions originate. [Eff. November 29, 1982; am, ren §11-60-5 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-6 Incineration. (a) No person shall cause or permit the emission from any incinerator of particulate matter to exceed 0.20 pounds per one hundred pounds (two grams per kilogram) of refuse charged.

(b) Emission tests shall be conducted at maximum burning capacity of the incinerator.

(c) The burning capacity of an incinerator shall be the manufacturer's or designer's guaranteed maximum rate or such other rate as may be determined by the director in accordance with good engineering practices. In cases of conflict, the determination made by the director shall govern.

(d) For the purposes of this chapter, the total of the capacities of all furnaces within one system shall be considered as the incinerator capacity. [Eff. November 29, 1982; am, ren §11-60-6 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-7 Non-fossil fuel burning boilers. (a) No person shall cause or permit the emissions of particulate matter from each bagasse burning boiler and its drier or driers in excess of 0.4 pound per hundred pounds of bagasse as burned. The bagasse combustion rate shall be determined using the procedures described in "Method to Calculate Bagasse Combustion Rate" (Hawaiian Sugar Planters' Association, December 26, 1975) and "Correction of the Flue Gas Rate for Scrubber Moisture" (Hawaiian Sugar Planters' Association, August 31, 1976).

TABLE 8-1

Process Weight Rate pounds per hour	Rate of Emission pounds per hour
100	0.551
200	0.877
400	1.40
600	1.83
800	2.22
1,000	2.58
1,500	3.38
2,000	4.10
2,500	4.76
3,000	5.38
3,500	5.96
4,000	6.52
5,000	7.58
6,000	8.56
7,000	9.49
8,000	10.4
9,000	11.2
12,000	13.6
16,000	16.5
18,000	17.9
20,000	19.2
30,000	25.2
40,000	30.5
50,000	35.4
60,000 or more	40.0

Interpolation of the data in this table for process weight rates up to sixty thousand pounds per hour shall be accomplished by use of the equation $E = 4.10\ p^{0.67}$, E = rate of emission in pounds per hour and p = process weight rate in tons per hour.

§11-60-9 Sulfur oxides from fuel combustion. (a) No person shall burn, sell, or make available for sale for burning in fuel burning equipment, any fuel containing in excess of two per cent sulfur by weight except for fuel used in ocean-going vessels.

(b) No person operating fossil-fuel fired power and steam generating facilities having a power generating output in excess of twenty-five megawatts or a heat input greater than two hundred fifty million BTU/per hour shall burn fuel containing in excess of 0.5 per cent sulfur by weight.

(3) Other equipment or means of equal efficiency for purposes of air pollution control as may be approved by the director.

(b) No person shall place, store, or hold in any new stationary storage vessel of more than the two hundred fifty-gallon (nine hundred fifty-liter) capacity any volatile organic compound unless such vessel is equipped with a permanent submerged fill pipe or is a pressure tank as described in subsection (a) or is fitted with a vapor recovery system as described in subsection (a)(2).

(c) Underground tanks shall be exempted from requirements of subsection (a) if the total volume of volatile organic compounds added to and taken from a tank annually does not exceed twice the volume of the tank. [Eff. November 29, 1982; am, ren §11-60-10 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-11 Volatile organic compound water separation. (a) No person shall use any compartment of any single or multiple compartment volatile organic compound water separator which receives effluent water containing two hundred gallons (seven hundred sixty liters) a day or more of any volatile organic compound from any equipment processing, refining, treating, storing, or handling volatile organic compounds having a Reid vapor pressure of 0.5 pounds per square inch or greater unless such compartment is equipped with one of the vapor loss control devices in subsections (b) to (e), properly installed, in good working order, and in operation.

(b) A container having all openings sealed and totally enclosing the liquid contents. All gauging and sampling devices shall be gas-tight except when gauging or sampling is taking place.

(c) A container equipped with a floating roof, consisting of a pontoon type, double deck type roof, or internal floating cover, which will rest on the surface of the contents and be equipped with a closure seal or seals to close the space between the roof edge and container wall. All gauging and sampling devices shall be gas-tight except when gauging or sampling is taking place.

(d) A container equipped with a vapor recovery system consisting of a vapor gathering system capable of collecting the organic vapors and gases discharged and a vapor disposal system capable of processing such organic vapors and gases so as to prevent their emission to the atmosphere

(5) The reasons that it would be impossible or impractical to shut down the source operation during the maintenance period.

(b) In the event that any emission source, air pollution control equipment, or related facility starts up, shuts down, or breaks down in such a manner to cause the emission of air pollutants in violation of applicable rules, the person responsible for the equipment shall immediately notify the department of the failure or breakdown.

(1) The person responsible shall provide the following information within five days of the notification:
  (A) Identification of emission points;
  (B) Magnitude of the excess emissions;
  (C) Time and duration of the excess emissions;
  (D) Identity of the process or control equipment causing the excess emissions;
  (E) Cause and nature of the excess emissions;
  (F) Description of the steps taken to remedy the situation, prevent a recurrence, limit the excessive emissions, and to assure that the breakdown does not interfere with the attainment and maintenance of the NAAQS;
  (G) Documentation that the equipment or process were at all times maintained and operated in a manner consistent with good practice for minimizing emissions; and
  (H) The excess emissions are not part of a recurring pattern indicative of inadequate design, operation or maintenance.

(2) Upon receipt of the report of excessive emissions and required information, the department may issue a notice of violation to institute an enforcement procedure to provide the source an opportunity to fully explain the circumstances of the violation. The information submitted and all other information to further explain the circumstances shall be utilized to assess the need for further action. [Eff. November 29, 1982; am, ren §11-60-14 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-15 Sampling, testing, and reporting methods. (a) All sampling and testing shall be made and the results calculated in accordance with reference methods specified by EPA or in the absence of an EPA reference method, test procedures approved by the director. All tests shall be made under the direction of persons knowledgeable in the field of air pollution control.

confidentiality due to its nature concerning secret processes or secret methods of manufacture, and with respect to each confidential data providing the following documentations:

(1) If, and how, each data concerns secret processes or secret methods of manufacture;
(2) Who has access to each data;
(3) What steps have been taken to protect the secrecy of each data; and
(4) Why it is believed each data must be accorded confidential treatment and the anticipated prejudice should disclosure be made.

Any data submitted to the department without a request for confidential treatment in accordance with this section shall be considered public record.

(b) All requests for public records shall be in writing, addressed to the director and shall identify or describe the character of the requested record. Upon approval by the director, the requested public record shall be available to the requestor for inspection and copying during established office hours. The director shall charge the requestor a reasonable cost for reproduction of any public record, but not less than twenty-five cents per page, sheet, or fraction thereof. [Eff. and comp. APR 14 1986] (Auth: HRS §§91-2, 92-21, 92-50, 92-51, 342-5, 342-10; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61) (Imp: HRS §§91-2, 91-21, 92-50, 92-51, 342-5, 342-10; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61)

§11-60-17 Air quality models. (a) All estimates of ambient concentrations required shall be based on the applicable air quality models, data bases, and other requirements specified in the "Guideline on Air Quality Models" (OAQPS 1.2-080, U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, April 1978).

(b) Where an air quality impact model specified in the "Guideline on Air Quality Models" is inappropriate, the model may be modified or another model substituted on written request to the director. The public shall be provided the opportunity to comment. Written approval of the director and the EPA administrator shall be obtained for any modification or substitution. Methods such as those outlined in the "Workbook for the Comparison of Air Quality Models" (U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, May 1978) may be used to determine the comparability of air quality models. [Eff. and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61)

A warning shall be declared when any one of the following levels is reached:

(1) SO_2 - one thousand six hundred ug/m^3 (0.6 ppm), twenty-four-hour average;

(2) Particulate matter - six hundred twenty-five ug/m^3, twenty-four-hour average;

(3) SO_2 and particulate matter combined - product of SO_2, ug/m^3, twenty-four-hour average and particulate matter, ug/m^3, twenty-four-hour average equal to 261×10^3;

(4) CO - thirty-four mg/m^3 (30 ppm), eight-hour average;

(5) Ozone - eight hundred ug/m^3 (0.4 ppm), one-hour average; or

(6) NO_2 - two thousand two hundred sixty ug/m^3 (1.2 ppm), one-hour average; five hundred sixty-five ug/m^3 (0.3 ppm), twenty-four-hour average;

and meteorological conditions are such that this condition can be expected to continue for twelve or more hours.

(f) "Emergency": The emergency level is reached when the warning level for a pollutant has been exceeded and:

(1) The concentrations of the pollutant are continuing to increase; or

(2) The director determines that, because of meteorological or other facts, the concentrations will continue to increase; or

(3) When any one of the following levels is reached:

(A) SO_2 - two thousand one hundred ug/m^3 (0.8 ppm), twenty-four-hour average;

(B) Particulate matter - eight hundred seventy-five ug/m^3, twenty-four-hour average;

(C) SO_2 and particulate matter combined - product of SO_2, ug/m^3, twenty-four-hour average and particulate matter, ug/m^3, twenty-four-hour average equal to 393×10^3;

(D) CO - forty-six mg/m^3 (forty ppm), eight-hour average;

(E) Ozone - one thousand ug/m^3 (0.5 ppm), one-hour average; or

(F) NO_2 - three thousand ug/m^3 (1.6 ppm), one-hour average; seven hundred fifty ug/m^3 (0.4 ppm), twenty-four-hour average.

(g) "Termination": Once declared, any episode level reached by application of these criteria shall remain in effect until the criteria for that level are no longer met. At that time, the next lower episode level shall be assumed. [Eff. November 29, 1982; am, ren §11-60-19 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-9, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

(3) Fires to abate a fire hazard, providing hazard is so declared by the fire department or district forester having jurisdiction;
(4) Fires for prevention or control of disease or pests as approved by the director;
(5) Fires for training personnel in the methods of fighting fires;
(6) Fires for the disposal of dangerous materials, where there is no alternate method of disposal and burning is approved in advance by the director;
(7) Fires for residential bathing purposes; and
(8) Fires for the burning of leaves, grass, weeds, wood, paper, and similar materials on one's own premises, not exceeding four family units and twenty-five pounds per day, per unit, provided such burning is not within fifty feet of any habitable building, is attended or supervised by an adult person and is completed within daylight hours (9:00 a.m. to 6:00 p.m.) provided that such burning shall not be in violation of the regulations of other fire control agencies and shall be subject to "no-burn" days as specified in section 11-60-34. This exception shall not apply to the City and County of Honolulu. [Eff. November 29, 1982; am, ren §11-60-31 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-32 Agricultural burning, permit requirement. No person, engaged in any agricultural operation, shall cause or permit agricultural burning without first obtaining an agricultural burning permit from the director. Failure to comply with the terms and conditions of the permit or this chapter shall invalidate the permit. No agricultural permit shall be granted for, or be construed to permit, the open burning of trash and other wastes that have been handled or processed by factory operations. [Eff. November 29, 1982; am, ren §11-60-32 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-33 Agricultural burning, applications. (a) Applications shall be made on forms specified by the director and shall be accompanied by two copies of complete data which will include maps of areas to be burned showing fields by appropriate numbers and acreage, direction of prevailing winds, location of residential, school, commercial establishments, public

area, date and time of day, prevailing wind direction and speed, rainfall in preceding twenty-four hours, type of material, and any other pertinent data as required by the director.

(b) In recording meteorological data required by subsection (a), the permittee may use national weather service data or, on the permittee's own motion, conduct monitoring of conditions provided instruments used have been approved by the director. [Eff. November 29, 1982; am, ren §11-60-35 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-6, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-36 Agricultural burning, action on application. (a) The director shall act on an application within a reasonable time, but not to exceed ninety calendar days from the date the complete application is received, and shall notify the applicant in writing of the approval or denial of the application. If the director has not acted within the ninety calendar-day period, the application shall be deemed to have been approved.

(b) All applications shall be submitted to the Department of Health, 1250 Punchbowl Street, Honolulu, HI 96813.

(c) If an application is denied, the applicant may request a hearing in accordance with chapter 91, HRS.

(d) The permit may be granted for a period of up to one year from the date of approval.

(e) On the director's own motion or the application of any person, the director may modify, suspend, or revoke a permit if, after affording the applicant a hearing in accordance with chapter 91, HRS, it is determined that:

(1) Any condition of the permit has been violated;
(2) Any rule of the department has been violated;
(3) Any provision of chapter 342, HRS, has been violated;
(4) The maintenance or attainment of NAAQS will be interfered with; or
(5) The action is in the public interest.

(f) The permit shall not be transferable, whether by operation of law or otherwise or from one person to another.

(g) Every applicant for a permit shall pay a filing fee according to the following schedule:

(1) Less than ten acres - $10
(2) Ten to one hundred acres - $30
(3) Greater than one hundred acres - $75

The acreage shall be the total acreage designated to be burned as specified in the permit. The filing fee shall be submitted with the application and

(4) Laboratory equipment used exclusively for chemical or physical analyses;
(5) Ocean-going vessels;
(6) Fuel burning equipment, other than smoke house generators, which is used in a private dwelling; or has a BTU gross input rate of less than five hundred thousand BTU per hour; or is used for space heating, other than boilers and hot air furnaces;
(7) Steam generators, steam superheaters, water boilers, water heaters, and closed heat transfer system that have a maximum gross heat input rate of less than two hundred fifty million BTU per hour, and are fired exclusively with one of the following:
(A) Natural or synthetic gas;
(B) Liquified petroleum gas; or
(C) A combination of natural, synthetic, or liquified petroleum gas;
(8) Paint spraying operations utilizing paint spray booths;
(9) Woodworking shops with a sawdust collection system;
(10) Any stationary tank, reservoir, or other container of capacity equal to or less than forty thousand gallons storing volatile organic compounds;
(11) Standby generators used exclusively to provide electricity and standby sewage pump drives, both used only during power outages and fired exclusively by any of the following fuels:
(A) Natural or synthetic gas;
(B) Liquified petroleum gas;
(C) Fuel oil No. 1 or No. 2; or
(D) Diesel fuel oil No. 1D or No. 2D;
(12) Other minor sources as specified by the director.

(d) Issuance of any authority to construct or permit to operate shall not relieve any owner or operator of the responsibility to comply fully with applicable provisions of this chapter and any other requirements under county, state, or federal law. [Eff. November 29, 1982; am, ren §11-60-40 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-41 Conditions for considering applications. (a) The director shall approve an application for authority to construct if the applicant can show to the satisfaction of the director that:
(1) The best available control technology is provided to control those pollutants subject to NAAQS or state ambient air quality standards that the stationary source or modification would emit in significant amounts considering any limitation, enforceable by the director, on the source to emit a pollutant;
(2) The applicable rules of this chapter and any applicable

(5) If requested by the director, an analysis of the air quality impact and the nature and extent of any or all general commercial, residential, industrial and other growth which has occurred in the area the source or modification affects;
(6) If requested by the director, results of source emission testing, ambient air quality monitoring, or both;
(7) If requested by the director, information on other available control technologies; and
(8) Other information as the director may require.

(c) Every application shall be signed by the applicant and shall constitute an acknowledgement that the applicant assumes responsibility for the construction, modification, or operation of the source in accordance with the permit conditions and this chapter. The application shall be signed by one of the following:
(1) In the case of corporations, by a principal executive officer of at least the level of vice president, or a duly authorized representative, if that representative is responsible for the overall operation of the source;
(2) In the case of a partnership, by a general partner;
(3) In the case of a sole proprietorship, by the proprietor; or
(4) In the case of a county, state, or federal source, by either a principal executive officer, ranking elected official, or other duly authorized employee. [Eff. November 29, 1982; am, ren §11-60-42 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-43 Fees. (a) Every applicant for authority to construct and permit to operate shall pay the applicable fees as set forth in section 11-60-44. The fee shall be submitted with the application and shall not be refunded nor applied to any subsequent application.

(b) Any federal, state, or county government agency shall be exempt from paying all fees as prescribed in this section.

(c) Fees shall be made payable to the State of Hawaii. [Eff. November 29, 1982; am, ren §11-60-43 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-44 Fee schedule. The fee schedule for filing of an application shall be as follows:

where all relevant non-confidential documents will be available for public inspection;

(3) The director shall send a copy of the public notice to the applicant, the EPA administrator, the offices of the chief executives of the counties where the source is located or would be located, and any federal land manager whose lands may be affected by emissions from the source or modification;

(4) The director shall provide a period of thirty days following the date of the public notice during which time interested persons may submit written comments on the air quality impact of the source, alternatives to it, the control technology required, and other appropriate considerations; and

(5) The director, on the director's sole discretion or on the written request of any person, may hold a public hearing if the public hearing would aid in the director's decision:

(A) Any request for a public hearing shall be filed within the thirty-day period prescribed in paragraph (4) and shall indicate the interest of the party filing the request and the reasons why a hearing is warranted; and

(B) The director shall publish the public notice for a hearing at least thirty days in advance of the hearing date and shall conduct the hearing in the geographical area of the proposed source.

(d) The applicant may choose, or the director may order the applicant to respond in writing within thirty days after the period for public comment has ended, or within thirty days after the public hearing is held, whichever is later, to the public comments received.

(e) The director shall consider all written comments submitted within the thirty days of the date of the public notice, all comments received at any public hearing and the applicant's responses, if any, in making a final decision on the application. The director shall make the written public comments and applicant's responses available for public inspection.

(f) The director's written decision on the application shall be available for public inspection.

(g) Any person may request in writing notification of applications pending with the department. The request shall be filed with the director and shall describe or identify the type of applications for which notification is sought. The request shall be filed on an annual calendar basis and the request shall be granted for the calendar year only. [Eff. and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61)

(1) The permittee has notified the director in writing that the construction, modification, or relocation is substantially complete;
(2) The permittee has submitted an application to the director for a permit to operate; and
(3) The temporary use or operation shall be in conformance with the conditions of the authority to construct.

The temporary use or operation shall not be for more than one hundred eighty days. [Eff. November 29, 1982; am, ren §11-60-47 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-48 Period of permit. (a) Authority to construct or permit to operate shall not be issued for any term exceeding five years.

(b) On written request, the director may extend the authority to construct period upon satisfactory showing that an extension is justified; provided in no case shall an extension be granted if the combined term of the originally issued permit and any extension or extensions exceeds five years.

(c) On application, permit to operate may be renewed for any term not to exceed five years. [Eff. November 29, 1982; am, ren §11-60-48 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-49 Holding of permit. (a) The authority to construct or permit to operate shall be maintained at or near the stationary source for which the authority to construct or permit to operate was issued and shall be made available for inspection upon the director's request.

(b) No person shall wilfully deface, alter, forge, counterfeit, or falsify an authority to construct or permit to operate. [Eff. November 29, 1982; am, ren §11-60-49 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-50 Transfer of permit. (a) Authority to construct or permit to operate shall not be transferable, whether by operation of law or otherwise, either from one location to another or from one piece of equipment to another.

(b) Authority to construct or permit to operate shall not be transferable, whether by operation of law or otherwise, from one person to

(4) The authority to construct or permit to operate was obtained by misrepresentation, or failure to disclose fully all relevant facts;
(5) The source is constructed or operated not in accordance with the application for authority to construct or permit to operate and any information submitted as part thereof;
(6) There is a change in any condition that requires either a temporary or permanent reduction or elimination of the permitted discharge; or
(7) The action is in the public interest, as defined in section 342-6, HRS.

(b) If the director determines that any person is violating any provision of this chapter, the director may serve a cease and desist order in accordance with chapter 91, HRS. [Eff. November 29, 1982; am, ren §11-60-53 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52)

§11-60-54 Reporting discontinuance. The permanent discontinuance of the construction, modification, relocation, or operation of any stationary source shall be reported, in writing, to the director within thirty days of the discontinuance by the person to whom the authority to construct or permit to operate was issued. [Eff. November 29, 1982; am, ren §11-60-54 and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7416; 40 C.F.R. Parts 50, 51, 52)

§§11-60-55 to 11-60-58 (Reserved)

SUBCHAPTER 4

PREVENTION OF SIGNIFICANT DETERIORATION REVIEW

§11-60-59 Source applicability. (a) The prevention of significant deterioration review requirements of this subchapter are additional requirements for considering an application for authority to construct required by subchapter 3. The procedures and provisions of subchapter 3 shall govern the prevention of significant deterioration review requirements of this subchapter. The following stationary sources shall comply with this subchapter:

(A) Coal cleaning plants (with thermal dryers);
(B) Kraft pulp mills;
(C) Portland cement plants;
(D) Primary zinc smelters;
(E) Iron and steel mills;
(F) Primary aluminum ore reduction plants;
(G) Primary copper smelters;
(H) Municipal incinerators capable of charging more than 250 tons of refuse per day;
(I) Hydrofluoric, sulfuric, or nitric acid plants;
(J) Petroleum refineries;
(K) Lime plants;
(L) Phosphate rock processing plants;
(M) Coke oven batteries;
(N) Sulfur recovery plants;
(O) Carbon black plants (furnace process);
(P) Primary lead smelters;
(Q) Fuel conversion plants;
(R) Sintering plants;
(S) Secondary metal production plants;
(T) Chemical process plants;
(U) Fossil-fuel boilers (or combination thereof) totaling more than two hundred fifty million British thermal units per hour heat input;
(V) Petroleum storage and transfer units with a total storage capacity exceeding three hundred thousand barrels;
(W) Taconite ore processing plants;
(X) Glass fiber processing plants;
(Y) Charcoal production plants;
(Z) Fossil fuel-fired steam electric plants of more than two hundred fifty million British thermal units per hour heat input;
(AA) Any other stationary source category which, as of August 7, 1980, has an applicable Standard of Performance for New Stationary Sources or a National Emission Standard for Hazardous Air Pollutants; or

(5) The source is a portable stationary source which has previously received authority to construct in conformance with this subchapter provided that:
(A) The source is to be relocated to a new location for a period of twelve consecutive months or less;
(B) The emissions from the source would not exceed its allowable emissions; and
(C) The emissions from the source would impact no class I area and no area where an applicable increment is known to be violated.

C.F.R. Parts 50, 51, 52, 60, 61) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61)

§11-60-61 Additional conditions for considering applications. (a) An applicant for authority to construct shall demonstrate to the satisfaction of the director that:

(1) A major stationary source is provided with the best available control technology for each pollutant subject to regulation under the Clean Air Act that it would have the potential to emit in significant amounts;

(2) A major modification is provided with the best available control technology for each pollutant subject to regulation under the Clean Air Act for which it would be a significant net emissions increase at the source. This requirement applies to each proposed emissions unit at which a net emissions increase in the pollutant would occur as a result of a physical change or change in the method of operation in the unit;

(3) For phased construction projects, the determination of best available control technology shall be reviewed and modified as appropriate at the latest reasonable time which occurs not later than eighteen months prior to commencement of construction of each independent phase of the project. At those times, the permittee shall demonstrate the adequacy of any previous determination of best available control technology for the source as a condition of the authority to construct; and

(4) The allowable emission increases from a major stationary source or major modification, in conjunction with all other applicable emissions increases or reductions (including secondary emissions), would not cause or contribute to a violation of any applicable maximum allowable increase over the baseline concentration in any area.

(b) The director shall provide notice of any application for a major stationary source or major modification from which the emissions would affect a class I area, to the EPA administrator, federal land manager, and the federal official charged with direct responsibility for management of any lands within any such area. The director shall also provide the EPA administrator, federal land manager, and federal officials with a copy of the director's proposed action and shall make available to them any materials used in making the director's proposed action.

(1) The federal land manager may demonstrate to the director that the emissions from a major stationary source or major modification would have an adverse impact on the air quality related values (including visibility) of these lands,

(c) With respect to any pollutant for which no NAAQS or state ambient air quality standard exists, the analysis shall contain such air quality monitoring data as the director determines is necessary to assess ambient air quality for that pollutant in any area that the emissions of that pollutant would affect.

(d) With respect to any pollutant (other than nonmethane hydrocarbons) for which standards exist, the analysis shall contain continuous air quality monitoring data gathered for purposes of determining whether emissions of that pollutant would cause or contribute to a violation of the standard or any maximum allowable increase.

(e) The continuous air quality monitoring data that is required shall have been gathered over a period of at least one year and shall represent at least the year preceding receipt of the application, except that if the applicant, in the application for authority to construct, demonstrates to the satisfaction of the director that a complete and adequate analysis can be accomplished with monitoring data gathered over a period shorter than one year (but not to be less than four months), the data that is required shall have been gathered over at least that shorter period. For data that is gathered over a period shorter than one year, the applicant shall demonstrate through historical data or dispersion modeling that the data has been obtained during a time period when maximum air quality levels can be expected and are representative of average concentrations to be expected for pollutants with annual standards. The "Ambient Monitoring Guidelines for Prevention of Significant Deterioration" (U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711, November 1980) may be used for general guidelines on ambient monitoring.

(f) With respect to volatile organic compounds, the applicant may provide post-approval monitoring data for ozone in lieu of providing preconstruction data if all conditions listed in title 40 of the code of federal regulations, part 51, appendix S, section IV, as in effect on date of adoption (MAR 25 1986), are satisfied.

(g) The applicant shall submit an analysis of the impairment to visibility, soils, and vegetation that would occur as a result of the source or modification and general commercial, residential, industrial, and other growth associated with the source or modification. The applicant need not provide an analysis of the impact on vegetation having no significant commercial or recreational value.

(h) The applicant shall submit an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial, and other growth associated with the source or modification. [Eff. and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 52, 60, 61)

All remaining areas of the State shall be class II areas and may be redesignated in accordance with section 11-60-64. [Eff. and comp. APR 14 1986] (Auth: HRS §§342-3, 342-22; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 60, 61) (Imp: HRS §§342-3, 342-4, 342-22, 342-23; 42 U.S.C. §§7407, 7410, 7416; 40 C.F.R. Parts 50, 51, 60, 61)

§11-60-64 Redesignation. (a) The following areas may be redesignated only as class I or II:

(1) An area which as of August 7, 1977, exceeded ten thousand acres in size and was a national monument, a national primitive area, a national preserve, a national recreational area, a national wild and scenic river, a national wildlife refuge, a national lakeshore or seashore; and

(2) A national park or national wilderness area established after August 7, 1977, which exceeds ten thousand acres in size.

(b) Except as otherwise specified in section 11-60-63(b), the State may submit to the EPA administrator a proposal to redesignate areas of the state class I or class II as a revision to the Hawaii state implementation plan provided that:

(1) At least one public hearing has been held in accordance with the procedures established for the preparation, adoption, and submittal of state implementation plans (40 C.F.R. 51.4);

(2) Federal land managers whose lands may be affected by the proposed redesignation were notified at least thirty days prior to the public hearing;

(3) A discussion of the reasons for the proposed redesignation, including a satisfactory description and analysis of the health, environmental, economic, social, and energy effects of the proposed redesignation, was prepared and made available for public inspection at least thirty days prior to the hearing and the notice announcing the hearing contained appropriate notification of the availability of such discussion;

(4) Prior to the issuance of notice respecting the redesignation of an area that includes any federal lands, the State has provided written notice to the appropriate federal land manager and afforded adequate opportunity (not in excess of sixty days) to confer with the State respecting the redesignation and to submit written comments and recommendations. In redesignating any area with respect to which any federal land manager had submitted written comments and recommendations, the State shall have published a list of any inconsistency between that redesignation and those comments and recommendations (together with the reasons for making that redesignation against the recommendation of the federal land manager); and

The amendments to and compilation of chapter 11-60, Administrative Rules, on the Summary Page dated MAR 25 1986, were adopted on MAR 25 1986, following a public hearing on Oahu on May 21, 1984, in Hilo, Hawaii, on May 23, 1984, in Kailua-Kona, Hawaii, on May 24, 1984, on Kauai on May 17, 1984, on Maui on May 22, 1984, after public notice was given in the Honolulu Advertiser on April 17, 1984, in the Hawaii Tribune Herald on April 13, 1984, in West Hawaii Today on April 13, 1984, in the Garden Isle on April 16, 1984, and in the Maui News on April 13, 1984.

These rules shall take effect ten days after filing with the Office of the Lieutenant Governor.

LESLIE S. MATSUBARA
Director of Health

Dated: March 25, 1986

APPROVED:

GEORGE R. ARIYOSHI
Governor
State of Hawaii

Dated: April 2, 1986

April 3, 1986
Filed

APPROVED AS TO FORM:

Deputy Attorney General

LT. GOVERNOR'S OFFICE
1986 APR 3 AM 9 05
REC'D. BY

Rev. 11/90

DIVISION OF WATER RESOURCE MANAGEMENT

FROM: _____ DATE: 3/6/91 FILE IN: _____

TO:	INITIAL:	PLEASE:	REMARKS:
___	____ G. AKITA	___ See Me	Janet,
___	____ L. Nanbu	___ Take Action By____	I skimmed over this material
		___ Route to Your Branch	and it's confusing because I don't
___	____ E. Sakoda	___ Review & Comment	know a thing about this field.
___	____ G. Matsumoto	___ Draft Reply___	Jon.
___	____ E. Lau	___ Acknowledge Receipt	
___	____ L. Chang	___ Xerox ____copies	
___	____ Y. Shiroma	___ File	
___	____ _____	___ Mail	
___	____ _____		
___	____ _____		
___	____ _____	FOR YOUR:	
___	____ JJ. Jon		
___	____ _____	___ Approval	
___	____ _____	___ Signature	
___	____ _____	___ Information	
___	____ M. TAGOMORI		
___	____ S. Kokubun		

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PUNA GEOTHERMAL VENTURE

A Hawaii Partnership

March 5, 1992

Dr. John Lewin, M.D.
Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

Subject: Puna Geothermal Venture
Authority to Construct Permit No. A-833-975

Pursuant to Special Condition No. 29 of the subject document, Puna Geothermal Venture (PGV) respectfully submits the PGV Aerosol Test Plan for your review and approval. PGV believes this program outlines a comprehensive and thorough test plan which fulfills the department's requirements outlined in condition number 29.

The Aerosol Test Plan incorrectly lists, on page 1, the enabling permit number as A-834-796 with an issue date of December 9, 1991. The correct document is number A-833-975, revised on January 13, 1992. We hope this error will not cause any inconvenience or delay the review of the document.

If there are any questions regarding this submittal, please feel free to contact me in the Hilo office at 961-2184.

Sincerely,

Maurice A. Richard
Vice President
Puna Geothermal Venture

Enclosure

cc:
P. Aki, DOH
B. Paty, DLNR
R. Nakano, HCPD
J. Swift, DLNR

92036.011

101 Aupuni Street, Suite 1014-B, Hilo, Hawaii 96720 • (808) 961-2184 • Facsimile (808) 961-3531

PGV Aerosol Test Plan
HDOH Special Condition No. 29

Prepared for
Puna Geothermal Venture

by
Thermochem, Inc.
5347 Skylane Blvd.
Santa Rosa, CA 95403

February 21, 1992

Table of Contents

PGV Aerosol Test Plan
HDOH Special Condition No. 29

1.0 Introduction

This test plan is intended to meet the Hawaii Department of Health (HDOH) requirements for particulate and aerosol emissions monitoring during the well clean-out and flow testing operations for the Puna Geothermal Venture (PGV) well KS-8 (condition 29). This special condition was added to ATC No. A-834-796 December 9, 1991. The condition specifies that PGV shall "physically and chemically characterize the particulate and aerosol emissions and corresponding ambient concentration from these operations." For the purposes of this test plan, the condition is interpreted to mean that atmospheric steam releases resulting from the operations described above must be source tested for all potentially toxic particulate and aerosol phase inorganic constituents that may be present in the produced geothermal fluid, including the chemical species listed in the original ATC permit. The term "source test" refers to quantification of constituent concentrations and mass emission rates at the emission source point. In addition to the source testing, ambient air monitoring near the zone of maximum impact for the same constituents in respirable form (PM10) is assumed to be required during the steam release operations.

2.0 KS-8 Clean-Out Operation

The initial well clean-out operation will involve full flow of KS-8 to the Pad D vent muffler for a maximum duration of 4 hours. The expected steam flow rate at atmospheric flash during this operation is between 250 and 400 KPH (1000 lbs/hr). Sodium hydroxide and water will be injected upstream of the muffler for H_2S abatement. All brine, particulate, and residual H_2S abatement fluids will be discharged to the vent muffler, the bulk of which will be separated from the vapor phase by the inertial cyclone action of the muffler and drained to the Pad D sump. The muffler stack dimensions are 15 feet in diameter and 20 feet in height, resulting in exit velocities of 10.5 to 16.9 ft/sec at the anticipated flowrates. The steam will be saturated at a temperature of approximately 212°F.

2.1 Emission Source Test

Source testing will be conducted during the well clean-out operation to quantitate the concentrations and emission rates of total particulate matter and specific inorganic constituents. The stack samples will be collected as close as possible to isokinetic sampling rates, given the expected variability in vent flowrates. Since the well vent operation is limited to 4 hours, the steam flow- rate may not approach steady-state conditions, making it very difficult to maintain precise isokinetic sampling rates. Cyclonic flow conditions may also limit the sampling accuracy.

Isokinetic sampling, where velocities through the sample nozzle match stack velocities at the sample point, are required to obtain representative samples of particulate, droplets and aerosols relative to the bulk vapor phase. Precise isokinetic sampling is critical for particles above 10 um, and becomes less important at smaller size ranges. Very fine particles (< 1 um) tend to follow gas stream lines in the flow and are not disrupted by the presence of a sample nozzle.

Three sample ports for the source test probes will be installed 5 feet below the top lip of the vent muffler, off-set 120° apart (see diagram 2-1). The probes will be traversed across the stack diameter at points of cross-sectional equal area (EPA method 1) to the maximum extent possible during the clean-out duration.

Stack velocities will be estimated from the two-phase discharge tube lip pressure measurements (James-tube) and direct velocity pressure measurements within the stack (S-type pitot tube) during the clean-out operation.

2.1.1 Cascade Impactor Test

During the well clean-out, a potential exists for the emission of solid particulate matter such as formation material (rock dust), cement, drilling mud and casing corrosion products. A cascade impactor collection train will be utilized during this operation to obtain samples primarily of solid particulate matter. The sample probe liner and cascade impactor device will

be heated to 350°F to evaporate liquid droplets and aerosols, thereby allowing the bulk of this material to be collected as solid particulate also.

The cascade impactor is a routine particulate source test device that separates particles by size range during collection through inertial separation and impaction. The impactor to be used for the KS-8 test contains 6 particulate sizing stages. The size distributions will be verified by scanning electron microscopy (SEM) of each collection stage after the test. Qualitative chemical and mineralogical composition data will also be obtained from the SEM scans by X-ray microprobe analysis.

Table 2-1 lists the approximate particle size ranges and mass detection limits for each impactor stage based on a total of 2 hours collection time.

The complete cascade impactor source test will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Initial constant weight of Teflon impactor substrates
2.0 Caliper gauge measurement of isokinetic nozzle diameters
3.0 Calibration curve for critical flow Venturi flow meter
4.0 Calibration curve for probe liner and impactor outlet thermocouples
5.0 Calibration curve for Venturi vacuum gauges
6.0 Caliper gauge measurement of S-type pitot tube dimensions
7.0 Calibration curve for pitot tube differential pressure (D.P.) gauges
8.0 Calibration curve for stack temperature thermocouple
9.0 Equal area traverse point lay-out
10.0 On-site barometric pressure
11.0 On-site leak test of impactor sample train
12.0 On-site leak test of pitot tube/D.P. gauge instrumentation

SOURCE TEST DATA COLLECTION

1.0 Traverse point location, clock time
2.0 Stack temperature (5 minute intervals)
3.0 Stack velocity, D.P. gauge (2 minute intervals)
4.0 James-tube lip pressure (5 minute intervals)
5.0 Venturi flow meter vacuum, upstream/downstream (2 minute intervals)
6.0 Probe liner and impactor outlet temperatures (5 minute intervals)

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final leak test of impactor sample train (on-site)
2.0 Final leak test of pitot tube/D.P. gauge instrumentation (on-site)
3.0 On-site barometric pressure
4.0 Total sample computed mass and volume
5.0 Stack velocities and average computed volumetric/mass flowrates
6.0 Mass flowrate estimates based on James-tube measurements
7.0 Average % isokinetic sampling rate
8.0 Caliper gauge check of isokinetic nozzle diameters
9.0 Calibration check of critical flow Venturi flow meter
10.0 Calibration check of probe liner and impactor outlet thermocouples
11.0 Calibration check of Venturi vacuum gauges
12.0 Caliper gauge check of S-type pitot tube dimensions
13.0 Calibration check of pitot tube differential pressure (D.P.) gauges
14.0 Calibration check of stack temperature thermocouple

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Final constant weight of Teflon impactor substrates
2.0 Particulate concentration at each impactor stage (mg/Kg , mg/m^3)
3.0 Total mass emission rate of particulate matter (Kg/hr)
4.0 Particle size distribution for each impactor stage (SEM)
5.0 Qualitative elemental and mineralogical composition of particulate (SEM)

Table 2-1 Cascade Impactor Detection Limits

Impactor Stage	Particle Size Range Minimum	Maximum	Detection Limit mg/Kg	mg/m3
1	10	—	0.095	0.059
2	3.8	10	0.095	0.059
3	1.8	3.8	0.095	0.059
4	1.0	1.8	0.095	0.059
5	0.50	1.0	0.095	0.059
6	0.25	0.50	0.095	0.059

Note: Detection limit based on 2 hrs. collection time.
Particle size ranges are estimated from D50 curves and will be verified by SEM analysis.

2.1.2 Impinger Train Test

The quantification of potentially toxic metals and other inorganic constituents will be performed by utilizing a modified EPA Combined Metals Train source test procedure. These tests will allow isokinetic collection of samples for analysis of total quantities of each constituent regardless of phase or size distribution.

Steam samples from the isokinetic probe will be condensed and trapped in a series of 3 impinger bottles containing an H_2O_2/HNO_3 solution for total metals analysis and $K_2Cr_2O_7/HNO_3$ solution for total mercury analysis. Samples for other inorganic constituents such as anions, boron and silica will be collected in a series of 3 impinger bottles containing deionized water (D.I.).

Samples collected in H_2O_2/HNO_3 solutions will be digested for total metals and analyzed by Inductively Coupled Argon Plasma Emission Spectroscopy (ICP) and Graphite Furnace Atomic Absorption (GFAA). Samples collected in $K_2Cr_2O_7/HNO_3$ solutions will be analyzed by Cold Vapor Atomic Absorption (CVAA) for total mercury. The samples collected in D.I. water impingers will be analyzed by ion chromatography (IC), wet chemical techniques or ICP, and Flame Atomic Absorption (FAA).

Each impinger bottle from each collection train will be analyzed separately to verify trapping efficiencies of the various analytes. High purity reagents (Ultrex grade) will be used in the impinger bottles and complete sets of sample train blanks will be collected before each test.

The D.I. water train samples will be analyzed for major species present in the discharge liquid phase (brine and abatement products) such as sodium, potassium and chloride, in addition to the other species. These constituents will be used as tracer species to calculate the quantity of liquid entrained in the vented steam and the amount of total dissolved solids emitted based on the discharge water analysis.

Table 2-2 lists the constituents to be analyzed in each train and their respective detection limits in terms of concentration and mass emission rate.

The complete impinger train source test will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Initial weights and solution volumes for each impinger bottle
2.0 Caliper gauge measurement of isokinetic nozzle diameters
3.0 Calibration curve for Dry Gas Test Meter (DGM)
4.0 Calibration check of field balance for impinger weights
5.0 Calibration curve for impinger train vacuum gauge
6.0 Calibration curve for impinger and DGM thermocouples
7.0 Caliper gauge measurement of S-type pitot tube dimensions
8.0 Calibration curve for pitot tube differential pressure (D.P.) gauges
9.0 Calibration curve for stack temperature thermocouple
10.0 Equal area traverse point lay-out
11.0 On-site barometric pressure
12.0 On-site leak test of impinger sample train
13.0 On-site leak test of pitot tube/D.P. gauge instrumentation
14.0 Initial DGM volume reading

SOURCE TEST DATA COLLECTION

1.0 Traverse point location, clock time
2.0 Stack temperature (5 minute intervals)
3.0 Stack velocity, D.P. gauge (2 minute intervals)
4.0 James-tube lip pressure (5 minute intervals)
5.0 Impinger and DGM temperature (5 minute intervals)
6.0 Impinger train vacuum (5 minute intervals)
7.0 Noncondensible gas flowrates, DGM (5 minute intervals)
8.0 Relative weight change of impinger bottles (5 minute intervals)

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final DGM volume reading, total noncondensible gas volume
2.0 Final leak test of impinger sample train (on-site)
3.0 Final leak test of pitot tube/D.P. gauge instrumentation (on-site)
4.0 On-site barometric pressure
5.0 Final impinger weights, total sample mass
6.0 Stack velocities and average computed volumetric/mass flowrates
7.0 Mass flowrate estimates based on James-tube measurements
8.0 Average % isokinetic sampling rate
9.0 Calibration check of Dry Gas Test Meter (DGM)
10.0 Calibration check of field balance for impinger weights
11.0 Calibration check of impinger train vacuum gauge
12.0 Calibration check of impinger and DGM thermocouples
13.0 Caliper gauge check of isokinetic nozzle diameters
14.0 Caliper gauge check of S-type pitot tube dimensions
15.0 Calibration check of pitot tube differential pressure (D.P.) gauges
16.0 Calibration check of stack temperature thermocouple

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Complete chemical analysis of each impinger solution (see table 2-2)
2.0 Total ug of analyte in each impinger bottle
3.0 Total concentration of each analyte (ug/Kg , ug/m^3)
4.0 Total mass emission rate of each analyte (g/hr)

Table 2-2 Impinger Train Detection Limits KS-8 Clean-out Operation

Analyte	Impinger Solution	Method	Detection Limit ug/Kg	Detection Limit ug/m3	Emission rate, lbs/hr @ 400 KPH Steam
MERCURY	K2Cr2O7/HNO3	CVAA	0.60	0.36	2.40E-04
ARSENIC	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
LEAD	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
IRON	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
MANGANESE	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
ZINC	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
BARIUM	H2O2/HNO3	GFAA	2.5	1.5	1.00E-03
CADMIUM	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
COPPER	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
CHROMIUM	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
NICKEL	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
SELENIUM	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
VANADIUM	H2O2/HNO3	GFAA	6.5	3.9	2.60E-03
SODIUM	D.I. Water	FAA	5	3.0	2.00E-03
POTASSIUM	D.I. Water	FAA	20	12	8.00E-03
BORON	D.I. Water	ICP	20	12	8.00E-03
CHLORIDE	D.I. Water	IC	25	15	1.00E-02
FLUORIDE	D.I. Water	IC	25	15	1.00E-02

Detection limit concentrations are relative to steam by mass (ug/Kg) and volume at 14.72 psia (ug/m3).

2.2 Ambient Air Monitoring

During the well clean-out operation, ambient air samples will be collected for total particulate matter, including aerosols, equal to or less than 10 microns in size (PM10). The PM10 size fraction will be collected since the primary area of concern is the ambient air impact of toxic respirable particles and total respirable particulate matter. Standard high-volume air samplers fitted with PM10 heads will be employed during the test.

The air samplers will be started 1 hour before the clean-out operation begins and shut-down 1 hour after steam venting is ceased from the Pad D vent muffler. The PM10 sampler air flowrates will be approximately 1.3 m^3/minute (46 CFM).

A total of 5 PM10 monitoring stations will be in operation during the well clean-out, with 1 station located upwind, 3 stations in separate downwind locations and 1 co-located downwind station (duplicate sampler). The station positions were determined on the basis of wind speed and direction data for the PGV site, collected in 1981 to 1982, and atmospheric dispersion modeling (ISCST) performed specifically for the emission source. The daytime wind rose was used to determine the highest probability wind direction during the clean-out operation, which will occur during daytime hours. The downwind stations will be located within the predicted zone of maximum plume impact based on the dispersion modeling results and the daytime wind rose. Station placement was also restricted by the availability of electrical power and site security, which limited sampling locations to the PGV project area or existing air monitoring stations.

The single upwind station will be located at the "Woods" air quality monitoring site, approximately 7,600 feet northwest of PGV Pad A. This site should receive minimal impact from the steam venting operations while being in close enough proximity to provide a reasonable representation of background concentrations in the impact monitoring zone.
The PM10 station positions are shown in diagram 2-2.

Meteorological data will be collected continuously at the PGV site (2 MET stations) during the flow event for estimation of the time-weighted exposure of each monitor to the plume and correction of measured concentrations to exposure times, if desired.

2.2.1 PM10 Filter Analysis

High purity quartz fiber filters will be used in the PM10 monitors to minimize background levels of analytes. Three blank filters from each lot will be analyzed for all target elements prior to the test and at least 3 blank filters will be analyzed with each set of samples.

All sample filters will be weighed before and after collection (at constant humidity) for gravimetric determination of total PM10.

Filter strips will be digested by the EPA recommended microwave extraction procedure and analyzed by Inductively Coupled Argon Plasma Emission Spectroscopy (ICP), Graphite Furnace Atomic Absorption (GFAA), and Cold Vapor Atomic Absorption (CVAA) for all metals analyses.

Additional filter sections will be ultrasonic bath/D.I. water extracted for anion and ammonium analyses by ion-chromatography and flow injection analysis techniques.

Table 2-3 lists the constituents to be analyzed and their approximate detection limits based on a 6-hour sampling period.

The complete ambient air monitoring tests will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Background determination of analytes in filter lots
2.0 Physical inspection of filters for imperfections
3.0 Initial filter weights at constant humidity
4.0 Calibration curve for high-volume flow meter
5.0 Initial flowrate check with filter installed (must be 1.1 to 1.7 m^3/minute)
6.0 Barometric pressure and ambient temperature (recorded at MET station)
7.0 Start/stop timer set-points for sampler and flow recorder
8.0 Sampler I.D., site location, filter I.D., date

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final flowrate check for sampler (re-start for 5 minutes)
2.0 Barometric pressure and ambient temperature (recorded at MET station)
3.0 Filter condition and I.D. number
4.0 Elapsed and stop times for sampler
5.0 Indicated total sample volume
6.0 Computed actual volume at standard conditions
7.0 Calibration check for high-volume flow meter
8.0 Data recovery from MET stations

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Final filter weight at constant humidity
2.0 Total concentration of PM10 (ug/m^3)
3.0 Complete chemical analysis of sections from each filter (see table 2-3)
4.0 Total concentration of each analyte (ug/m^3)
5.0 Corrected concentrations to time weighted plume exposures

Table 2-3 PM10 Monitor Detection Limits KS-8 Clean-out Operation

Analyte	Method	Detection Limit Total ug	ug/m3
ARSENIC	GFAA	0.5	0.0011
LEAD	GFAA	0.5	0.0011
IRON	ICP	5.0	0.011
MANGANESE	ICP	1.0	0.0021
ZINC	ICP	2.5	0.0053
BARIUM	ICP	1.0	0.0021
CADMIUM	ICP	2.0	0.0043
COPPER	ICP	2.0	0.0043
CHROMIUM	ICP	5.0	0.011
NICKEL	ICP	7.5	0.016
SELENIUM	GFAA	1.0	0.0021
VANADIUM	ICP	5.0	0.011
SODIUM	FAA	2.5	0.0053
POTASSIUM	FAA	10.0	0.021
CHLORIDE	IC	10.0	0.021
FLUORIDE	IC	10.0	0.021
Total PM10	Gravimetric	100	0.2

Detection limit concentrations are based on sampler flowrate of 1.3 m3/min and sampling interval of 6 hr.

3.0 KS-8 Flow Test

The 10-day flow test of KS-8 will involve steam flow up to 200 KPH or the maximum rate possible without exceeding the 5 lbs/hr H_2S emission limit. The two-phase well flow will be diverted from the Pad D vent muffler after clean-out to the Pad A high pressure separator which will operate at approximately 210 psig. The separated brine will flow into a second separator for a final low pressure flash before discharge to a rock pit. The low-pressure steam will combine with the high-pressure steam downstream of the high-pressure steam flow control valve in a final run of 16-inch pipe. Sodium hydroxide and water will be injected into the combined steam flow for H_2S abatement (see diagram 3-1).

This abated steam flow will be vented primarily from the Pad A in-ground rock muffler that has overall dimensions of approximately 100 ft. long by 40 ft. wide and 10 ft. deep. The steam and residual abatement chemicals will discharge to the center of a 30 in. diameter slotted pipe running 40 ft. axially beneath the rocks to diffuse the steam flow.

A portion of the abated steam flow will be diverted from the 16-inch pipeline immediately upstream of the in-ground rock muffler, through a 10-inch gate valve and pipeline to an above-ground vent muffler. This Pad A vent muffler is located adjacent to the in-ground rock muffler and measures 8 feet in diameter and 20 feet in height. The diverted steam flowrate to the vent muffler will range from 50 to 75 KPH, generating stack velocities of 7.4 to 11.1 ft/sec. The steam will be saturated at a temperature of approximately 212°F.

The diversion of steam and entrained abatement chemicals to the above-ground vent muffler will be necessary to obtain aerosol samples under known flow conditions. Isokinetic sampling and standardized sampling protocol can not be employed directly at the in-ground rock muffler, given the lack of a defined cross-sectional flow area and extremely variable velocity profiles. The steam flowrate through the Pad A vent muffler will be much more stable than the flow through the Pad D muffler (well clean-out operation), but similar complications due to cyclonic flow may still exist. The Pad A vent muffler will be partially filled with rock to simulate the in-ground rock muffler as closely as possible.

3.1 Emission Source Test

Source testing will be conducted during the KS-8 flow test to quantitate the concentrations and emission rates of specific inorganic constituents. These tests will be performed during the first half of the flow test, at periods when the well flow is near the maximum allowable rate. The flow test operation only involves the potential for emissions due to incomplete separation of steam from brine and abatement chemicals (liquid droplets and aerosols). The impinger train method will be sufficient to quantitate these emissions in terms of potentially toxic metals and total solids. The cascade impactor method will not be applicable due to the expected low concentration of solid particulate matter in the vapor phase.

Three sample ports for the source test probe will be installed 5 feet below the top lip of the vent muffler, off-set 120° apart (see diagram 3-2). The probe will be traversed across the stack diameter at points of cross-sectional equal area (EPA method 1) during the tests.

Stack velocities will be determined by direct velocity pressure measurements within the stack using an S-type pitot tube during the source tests.

3.1.1 Impinger Train Test

The quantification of potentially toxic metals and other inorganic constituents will be performed by utilizing a modified EPA Combined Metals Train source test procedure. These tests will allow isokinetic collection of samples for analysis of total quantities of each constituent regardless of phase or size distribution.

These impinger train tests will be conducted in exactly the same manner as the well clean-out impinger source tests (section 2.1.2). A total of 3 source tests including each impinger train type will be conducted during the flow test operation.

Table 3-1 lists the constituents to be analyzed in each train and their respective detection limits in terms of concentration and mass emission rate.

Table 3-1 Impinger Train Detection Limits KS-8 Flow-Test Operation

Analyte	Impinger Solution	Method	Detection Limit ug/Kg	Detection Limit ug/m3	Emission rate, lbs/hr @ 200 KPH Steam
MERCURY	K2Cr2O7/HNO3	CVAA	0.60	0.36	1.20E-04
ARSENIC	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
LEAD	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
IRON	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
MANGANESE	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
ZINC	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
BARIUM	H2O2/HNO3	GFAA	2.5	1.5	5.00E-04
CADMIUM	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
COPPER	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
CHROMIUM	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
NICKEL	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
SELENIUM	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
VANADIUM	H2O2/HNO3	GFAA	6.5	3.9	1.30E-03
SODIUM	D.I. Water	FAA	5	3.0	1.00E-03
POTASSIUM	D.I. Water	FAA	20	12	4.00E-03
BORON	D.I. Water	ICP	20	12	4.00E-03
CHLORIDE	D.I. Water	IC	25	15	5.00E-03
FLUORIDE	D.I. Water	IC	25	15	5.00E-03

Detection limit concentrations are relative to steam by mass (ug/Kg) and volume at 14.72 psia (ug/m3).

3.2 Ambient Air Monitoring

During the entire flow test operation, ambient air samples will be collected for total particulate matter, including aerosols, equal to or less than 10 microns in size (PM10). Standard high-volume air samplers fitted with PM10 heads will be employed during the test.

The air samplers will be started at noon each day and shut-down the following day at noon. Each PM10 monitor will collect one 24 hr. (± 1 hr.) integrated sample per day of the flow test. The PM10 sampler air flowrates will be approximately 1.3 m^3/minute (46 CFM).

A total of 5 PM10 monitoring stations will be in operation during the well flow test, with 1 station located upwind, 3 stations in separate downwind locations and 1 co-located downwind station. The initial station positions will remain the same as selected for the well clean-out operation, as described in section 2.2 (diagram 2-2). The stations may be re-located during the flow test to maximize exposure to the plume based on the current meteorological data.

Meteorological data will be collected continuously at the PGV site (2 MET stations) during the flow test for estimation of the time-weighted exposure of each monitor to the plume and correction of measured concentrations to exposure times, if desired.

The PM10 monitors will be operated in exactly the same manner as during the well clean-out operation, with the exception of the longer run time.

3.2.1 PM10 Filter Analysis

The PM10 filter analysis procedure will be identical to the well clean-out test procedures and the same data collection and quality control protocol will be employed (section 2.2.1.).

Table 3-2 lists the constituents to be analyzed and their approximate detection limits based on a 24-hour sampling period.

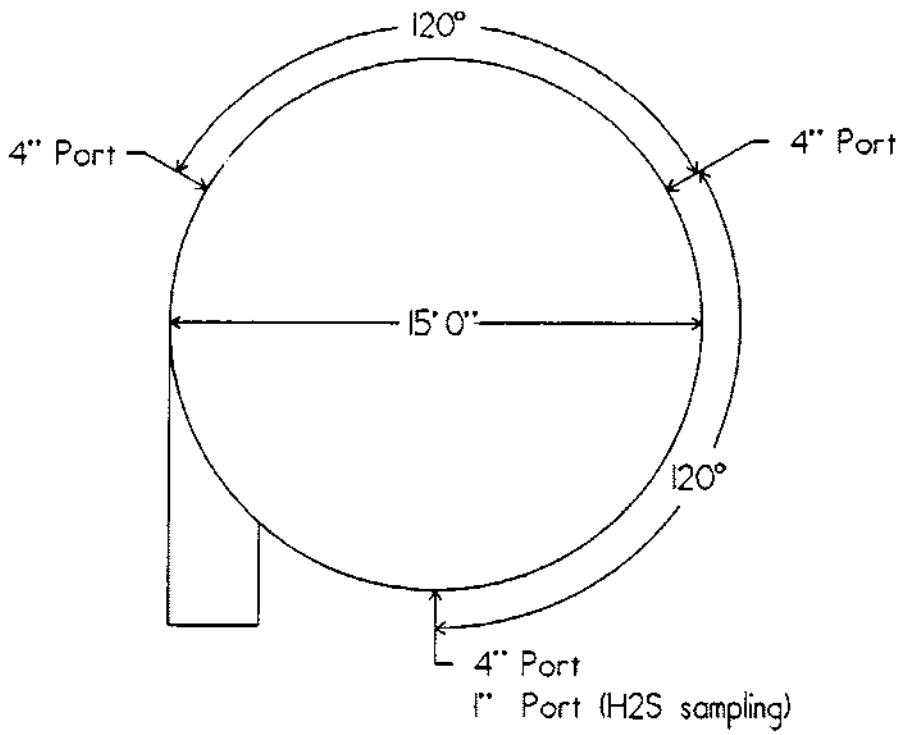
Table 3-2 PM10 Monitor Detection Limits
KS-8 Flow Test Operation

Analyte	Method	Detection Limit Total ug	ug/m3
ARSENIC	GFAA	0.5	0.0003
LEAD	GFAA	0.5	0.0003
IRON	ICP	5.0	0.0027
MANGANESE	ICP	1.0	0.0005
ZINC	ICP	2.5	0.0013
BARIUM	ICP	1.0	0.0005
CADMIUM	ICP	2.0	0.0011
COPPER	ICP	2.0	0.0011
CHROMIUM	ICP	5.0	0.0027
NICKEL	ICP	7.5	0.0040
SELENIUM	GFAA	1.0	0.0005
VANADIUM	ICP	5.0	0.0027
SODIUM	FAA	2.5	0.0013
POTASSIUM	FAA	10.0	0.0053
CHLORIDE	IC	10.0	0.0053
FLUORIDE	IC	10.0	0.0053
Total PM10	Gravimetric	100	0.05

Detection limit concentrations are based on sampler flowrate of 1.3 m3/min and sampling interval of 24 hr.

Appendix I

Diagrams



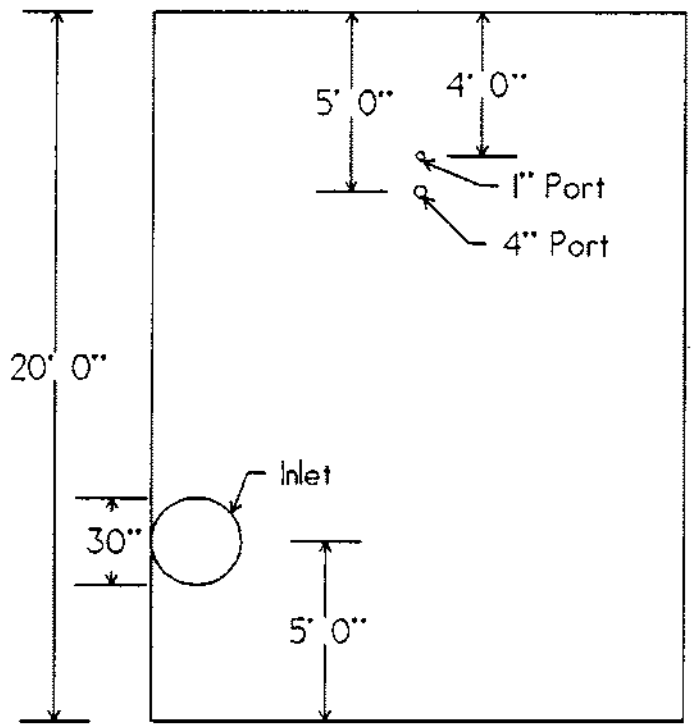
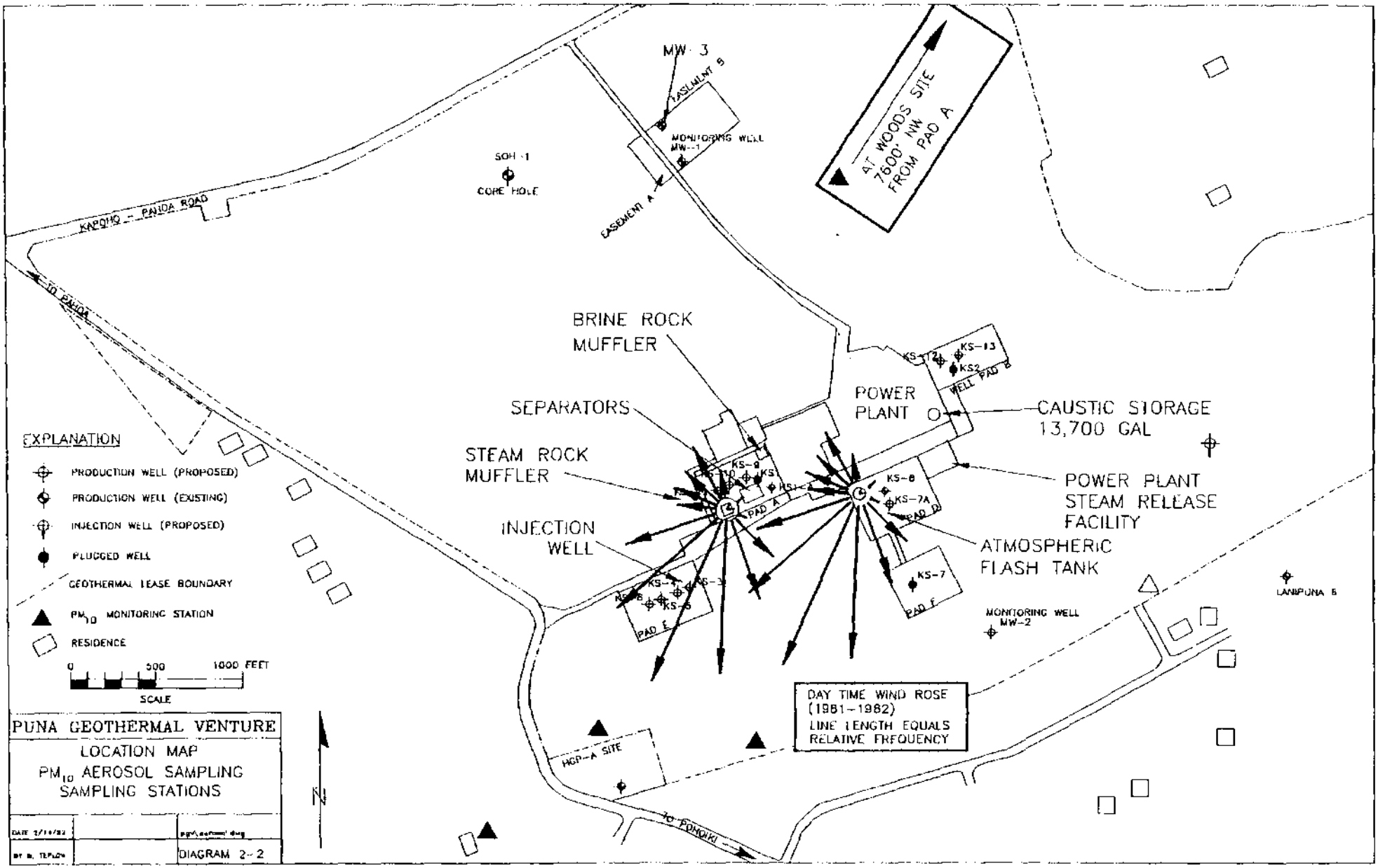
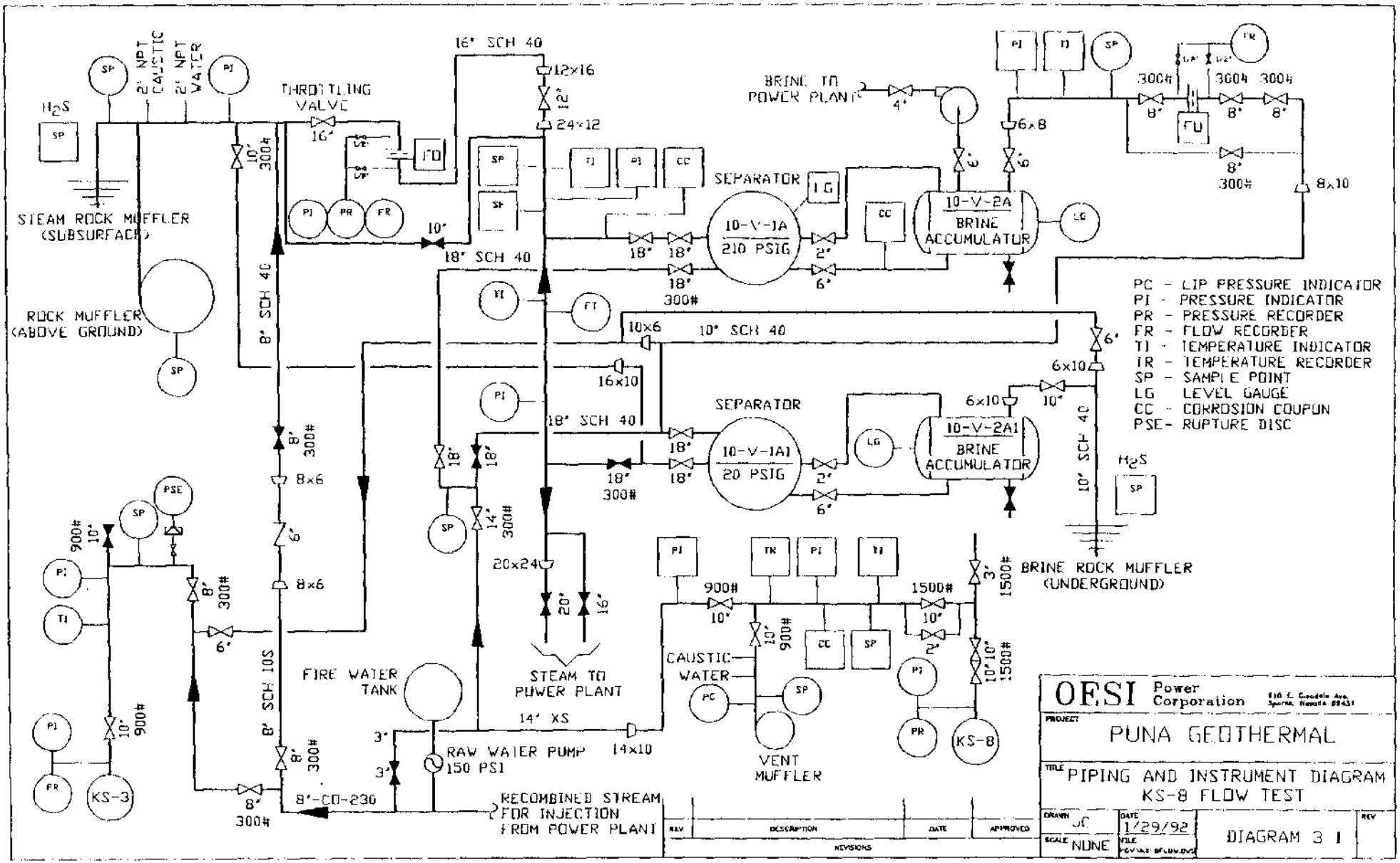
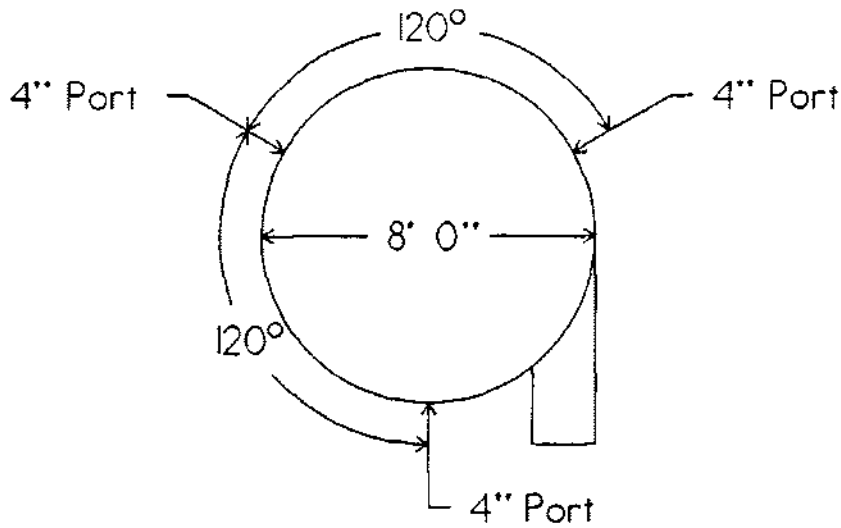


Diagram 2-1
KS-8 Vent Muffler. Pad D


MW-3
EASEMENT B
MONITORING WELL MW-1
SOH-1
CORE HOLE
EASEMENT A
KAPOHO - PAHOA ROAD
TO PAHOA
AT WOODS SITE 7600' NW FROM PAD A
BRINE ROCK MUFFLER
SEPARATORS
STEAM ROCK MUFFLER
INJECTION WELL
POWER PLANT
CAUSTIC STORAGE 13,700 GAL
POWER PLANT STEAM RELEASE FACILITY
ATMOSPHERIC FLASH TANK
KS-13
KS2
WELL PAD B
KS-8
KS-7A
PAD D
KS-7
PAD E
KS-1
KS-3
KS-5
PAD F
KS-9
KS-10
KS-4
PAD A
MONITORING WELL MW-2
LANIPUNA 6
HGP-A SITE
TO PONOHOKI
EXPLANATION
PRODUCTION WELL (PROPOSED)
PRODUCTION WELL (EXISTING)
INJECTION WELL (PROPOSED)
PLUGGED WELL
GEOTHERMAL LEASE BOUNDARY
PM_{10} MONITORING STATION
RESIDENCE
0 500 1000 FEET
SCALE
DAY TIME WIND ROSE (1981-1982) LINE LENGTH EQUALS RELATIVE FREQUENCY
N
PUNA GEOTHERMAL VENTURE
LOCATION MAP
PM_{10} AEROSOL SAMPLING
SAMPLING STATIONS
DATE 2/19/82
BY R. TEPLOW
DIAGRAM 2-2


PC - CIP PRESSURE INDICATOR
PI - PRESSURE INDICATOR
PR - PRESSURE RECORDER
FR - FLOW RECORDER
TI - TEMPERATURE INDICATOR
TR - TEMPERATURE RECORDER
SP - SAMPLE POINT
LG - LEVEL GAUGE
CC - CORROSION COUPON
PSE - RUPTURE DISC
STEAM ROCK MUFFLER (SUBSURFACE)
ROCK MUFFLER (ABOVE GROUND)
THROTTLING VALVE
SEPARATOR
10-V-1A 210 PSIG
10-V-2A BRINE ACCUMULATOR
10-V-1A1 20 PSIG
10-V-2A1 BRINE ACCUMULATOR
BRINE TO POWER PLANT
BRINE ROCK MUFFLER (UNDERGROUND)
STEAM TO POWER PLANT
FIRE WATER TANK
RAW WATER PUMP 150 PSI
RECOMBINED STREAM FOR INJECTION FROM POWER PLANT
CAUSTIC
WATER
VENT MUFFLER
KS-3
KS-8
OFSI Power Corporation
PROJECT PUNA GEOTHERMAL
TITLE PIPING AND INSTRUMENT DIAGRAM KS-8 FLOW TEST
DRAWN JC
DATE 1/29/92
SCALE NONE
DIAGRAM 3 1
REVISIONS



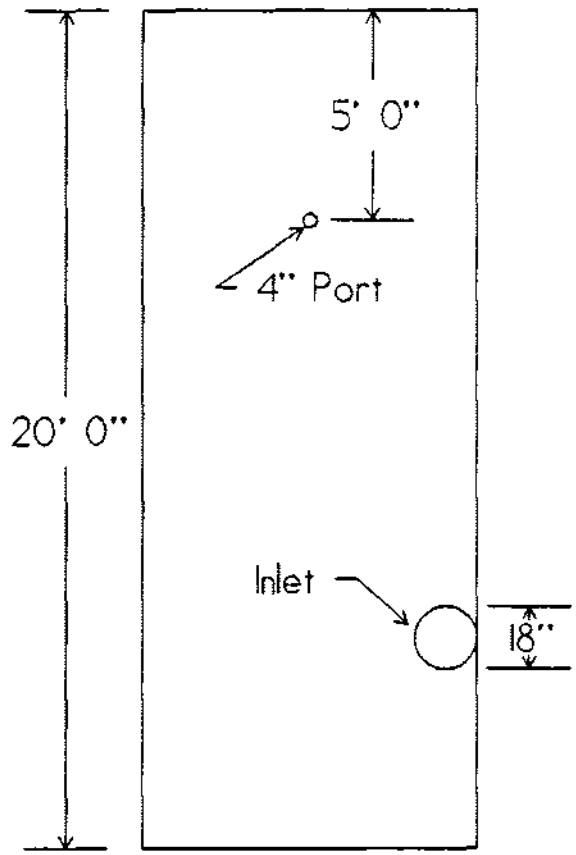


Diagram 3-2
Well Test Diversion Muffler. Pad A

OESI Power Corporation

June 17, 1991

Dr. John Lewin
Director
State Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Subj: REPORT ON UNCONTROLLED FLOW EVENT AS PER CONDITIONS #13 AND #26, ATC NO. A-833-795, ATTACHMENT II, WELLFIELD

Dear Dr. Lewin,

Attached is the Puna Geothermal Venture (PGV) report on the uncontrolled flow event of June 12, 1991, relative to Conditions #13 and #26 of the ATC No. A-833-795, Attachment II, Wellfield. We assume this report will be condfidential in nature.

If you have any questions concerning this submission or require additional information please do not hesitate to contact me.

Respectfully,

Thomas G. Kizis

Thomas G. Kizis
Permit Coordinator

Attachment:

TK/cd

cc: W. Paty, DLNR
M. Tagamori, DLNR
D. Nakano, DLNR
E. Tanaka, DLNR
N. Hayashi, Planning
C. Hew, DOH
N. Hirai, DLNR
B. Clark, PGV
B. Teplow, PGV
File: 7.13.2, 14.3.13, 14.3.26

(20799F/cd)

PUNA GEOTHERMAL VENTURE

14-3860 Kapoho Pahoa Road, Pahoa, Hawaii 96778
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Facsimile (808) 935-5562

REPORT ON UNCONTROLLED FLOW EVENT AS PER CONDITIONS #13 AND #26, ATC NO. A-833-795, ATTACHMENT II, WELLFIELD

This report covers the following five (5) items:

I. Probable cause of the blowout.
II. Actions that have or will be taken.
III. Estimated time before the well is controlled.
IV. Analysis of air quality impact from unabated emissions.
V. Air quality monitoring plan.

I. PROBABLE CAUSE OF THE BLOWOUT

The probable cause of failure was insufficient flow capacity to relieve the pressure kick. The insufficient relief flow area caused the annular preventer element to fail. The failed preventer element choked the flow path of the spacer between the Hydril and the rotating head. This resulted in a second rupture that damaged the mud line and the flow line. One of the ruptures caused the rig floor to be displaced. This prevented the driller from staying on the brake resulting in the kelly dropping down. The position of the kelly interfered with the complete closure of the pipe rams. The leakage around the pipe rams totally engulfed the rig floor in steam.

The complete lack of visibility on the rig floor and the displacement of the floor plates and other parts of the rig necessitated waiting until daylight before proceeding.

The rupture of the Hydril to rotating head spacer damaged the mud lines and the flow lines and some other features under the rig floor.

See Appendix for brief listing of events prior to well kick.

II. ACTIONS THAT HAVE OR WILL BE TAKEN
Evening of 6-12-91/11:06 p.m.-well kicked

1. Portions of the blow out preventer stack were damaged at the time that the steam or CO2 blew out above the Hydril.

2. The Hydril annular preventer was damaged by the excessive pressure impulse of the gas. The Hydril was inoperative.

3. The driller was forced away from the brake and the kelly dropped into the area of the pipe ram closure. Pipe rams will not close completely around the hexagonal kelly, therefore there was leakage around the kelly which prevented working on the floor. The rig floor was engulfed in steam.

4. The location was cleared and all personnel were accounted for.

5. Agencies and PGV personnel were notified.

6. The following decisions were made:

   a. Shut down electric power to the rig drawworks at the SCR panel.

   b. Air/Safety trailer was to be moved from the site to a location above the site and away from the well head.

   c. It was also decided to wait till daylight to reassess the situation and to take other actions around the rig and on the rig floor.

7. Personnel with safety gear moved the safety trailer from the site to a location above the site and away from the well head.

It is now the morning of 6/13/91. 6:00 AM

8. At dawn the HCR valve was opened venting the well through the choke manifold and the leakage around the kelly in the pipe rams.

9. It was at this point that it became known that

   a. The Hydril was inoperative

   b. The damage to the kill line and to the mud line had caused the pumps to pump onto the drill site and not down the drill pipe. The mud pits were dry.

   c. The bottom metal to metal pipe rams and the blind rams were still open.

10. Halliburton was mobilized to pump cold water down the drill pipe.

11. Parker crews rigged the Halliburton pumping lines to the standpipe and closed the lower valve. This established the path to pump fluids down the drill pipe.

12. Halliburton was rigged to pump down the drill pipe through cementing lines. (6/13/91 10:30 A.M.)

13. Closed in the choke line. Pumping 9.5 bbls/min. Pressure 1700 psi decreasing to 900 psi.

14. All operations consisted of:

    a. cleaning rig floor

    b. test operated draw work

    c. rig-up remote brake/clutch on drawworks

    d. lift kelly through B.O.P. to allow ram closure

    e. closed rams secured mass flow at approximately 6:30 a.m. on 6/14/91

15. Rigged up lines to Halliburton to pump down the annulus. Pump 5 bbls/min down the annulus. Initial pressure 1700 psi reducing to 1000 psi. Pumping down the drill pipe 4 bbls/min pressure still 900 psi. (6/14/91 4:00 AM)

16. Pumped LCM to plug off steel pipe rams. Flow was totally controlled. (6/15/91 10:00 AM)

17. Change out the top pipe rams. Steel rams with LCM held.(6/16/91 12:00 NOON)

18. Open steel pipe rams. Top pipe rams are closed. The choke line is closed. Continued to pump down the drill pipe and annulus.

19. Clean and reconstruct rig floor.

20. Repair Hydril. (6/17/91 2:00 AM)

21. Repairing rig and mud system.

THE FOLLOWING LIST OF ACTIVITIES ARE ONGOING

1. Continue to pump 4 bbls/min down the drill pipe and 5 1/2 bbls/min down the back side using Halliburton or rig pumps.

2. Continue to make rig repairs and alterations determined to be needed before proceeding.

3. Test for bottom hole pressure. Shut in pumps, measure shut in drill pipe pressure and shut in casing pressure.

4. If conditions permit run Kuster tools inside the drill pipe to determine whether there is interzone flow near bottom. Interzone flow will require using lost circulation material to shut off the outflow zone so that the source zone (and the outflow zone) can be cemented.

5. Determine kill weight mud.

6. Using drillers method circulate kill weight mud.

7. Circulate for 4 hours while recording mud temperature in and out.

8. Check for flow every 20 minutes.

9. With any indication of flow-bull head cold fluid to bottom. Prepare to cement through the bit nozzles.

III. Changes and repairs to the operational techniques beyond those indicated are being worked on at the present time. Changes to the well control design are being investigated with equipment being procedure as required.

The well as of this writing is under control, this meaning that all flows are contained, the well is being cooled nd pressure is dropping, preparation and planning is being made to evaluate the correct mud kill weight and to kill the well, subsequent to this a cement plug will be placed at 3475' and well prepared for complete installation of the 9-5/8 casing to insure well integrity is at its highest degree. At this point a finding of the analysis should be found and corrective measures taken, the permanent welihead configuration will be installed as well as the drilling out of the cement plug.

IV. ANALYSIS OF AIR QUALITY IMPACT FROM UNABATED EMISSIONS

Please refer to attached data.

V. AIR QUALITY MONITORING

PGV initiate increased air quality monitoring activity immediately following the uncontrolled flow of PGV well KS-8.

Included in this program were:

- Increased hourly monitoring of our existing air quality stations.
- Hourly measurements for H2S at selected sites within a one mile radius of well KS-8.
- Regular monitoring in the plume.
- Immediate responses to requests from residents to monitor air quality near their homes.

Our PGV Jerome 631-X Hydrogen Sulfide Analyzer was used to monitor the air quality during this expanded effort. This instrument has a detection limit of 1 ppb.

APPENDIX

Events prior to well kick:

6/9/91

Well depth 3401, circulated and built mud weight from 9 #/gal to 10.5 #/gal in 1/10 #/gal increments. Spotted 11.2 #/gal mud pill on bottom. Pulled out of hole with mud motor and angle building assembly, well flowed 1 inch stream continuosly. Ran in hole open ended with 5 inch drill pipe, circulated bottoms up at 13 3/8 inch casing shoe. Ran in hole to bottom, circulated bottoms up.

6/10/91

Cemented at 3401 in 12 1/4 inch hole through drill pipe with 50 sxs Hawaii cement, 20 % AA1, .75% CFR-3, and Halad-22. Displaced cement with 59 bbls. drilling mud. Pulled 3 stands and circulated, well continued to flow. Waited on cement, ran in hole and tagged cement at 3289 ft. Cemented through open ended drill pipe with 28 sxs Hawaii cement, 20 % AA-1, .75% CFR-3, .05% Halad-22A, displaced cement with 58 bbls of drilling mud. Pulled out of hole with drill pipe. Picked up drilling assembly and ran in hole to top of cement at 3151 ft. Drilled cement in 12 1/4 inch hole from 3151ft. to 3350 ft. Circulated to cool hole, conditioned mud.

6/11/91

Checked well for flow, well still flowing 1 inch stream to mud pits. Pulled out of hole and ran in hole open ended to 2135 ft., circulated, ran in hole to 3350 ft., circulated bottoms up. Spotted cement plug; cemented through drill pipe with 50 sxs Hawaii cement, 40% SAA1, .75% CFR-3, .3% Halad 22, displaced cement with 58 bbls. of drilling mud. Pulled up to 2135 ft., circulated and waited on cement. Ran in hole and tagged top of cement at 3140 ft. Circulated, pumped cement through drill pipe at 3120 ft; cemented with 35 sxs Hawaii cement, 40% SAA1, .75% CFR-3, .3% Halad-22, displaced cement with 54 bbls. drilling mud. Pulled 5 stands and squeezed cement at 2660 ft. Closed in well, squeezed away 3 bbls, at 300 psi. Pulled out of hole, picked up drilling assembly and ran in hole to 13 3/8 inch casing shoe, circulated.

6/12/91

Finished trip in hole, tagged top of cement at 2845 ft. Drilled cement in 12 1/4 hole from 2845 ft. to 3350 ft., circulated and conditioned mud in hole for log, pulled out of hole 8 stands, gained 20 bbls mud in pits, ran in hole to bottom, circulated and cooled hole. Checked for flow, 1 inch flow to pits, pulled out of hole, rigged up HLS logging services to run temperature log.

NOTE: The reasons for running the temperature logs at this depth were to develop diagnostics in an attempt to determine a correlation of temperatures in well KS-8 as compared to the temperatures encountered and logged in well KS-3.

Two HLS logging services logging runs were run, temperatures were continually displayed in the HLS logging truck and recorded on both magnetic tape and a standard paper temperture log. Well KS-8 was logged to a depth of 3325 ft., the top of cement at this time was at 3350 ft. The logging tool was not allowed to run into the bottom of the hole in order to avoid becoming stuck in the cement aat 3350 ft. The first temperature logging run encountered a maximum temperature of 370 degrees F. at a depth of 3325 ft. The temperature data was plotted on a graph of depth vs. temperature, on the same graph a temperature graph of well KS-3 was also plotted to obtain correlation between KS-8 and KS-3. (Graphs are part of this report).

A temperature correlation was obtained between KS-3 and KS-8 and it was determined from the correlation that based on temperature well KS-8 encountered temperatures equivalent to well KS-3 but at a depth of approximately 550 ft. deeper in well KS-8; ie, the temperature of 370 degrees F. encountered in well KS-8 was encountered at a depth of 3400 ft. wheras the temperature of 370 degrees F. was encountered in well KS-3 at a depth of 2850 ft. At the conclusion of HLS temperature log run # 1 while pulling out of the hole and attempting to log up the hole the HLS tool failed most likely because of excess temperature. (HLS wire-line was rated to a max temperature of 500 degrees F.)

It was decided by PGV personel to run an additional temperature log in well KS-8 in order to gain some idea of the rate of temperature buildup in the well. Another temperature tool was selected and HLS rigged up to run an additional temperature survey. In addition to the temperature tool it was decided to run two MRT's on top of the logging tool. MRT (maximum recording temperature). The HLS temperature tool lwas run in the well and temperature recording was commenced at a depth of 2204 ft, the shoe depth of the 13 3/8 inch casing. The HLS tool logged down to a depth of 3325 ft. where the tool failed due to excess temperature above what the tool and logging wireline were rated for. The HLS tool was brought out of the hole and the two MRT's

were examined to determine the maximum temperature to which they were exposed. The top MRT was broken and no data were obtainable, the bottom MRT failed to register a maximum temperature due it is thought to a faulty thermometer.

Afternoon of 6/12/91

A meeting was called in the offices of PGV, attendees were as per recall;

Bill Teplow
Jeff Sternfield
Bill Livesay
Butch Clark
Terry Crowson
Wendell Howard

It was decided at the meeting referred to above that PGV would elect to drill deeper in order to set the 9 5/8 inch casing in the well at a depth nearer to 4000 ft. as originally detailed in the well prognosis. It was decided to drill out the cement in the bottom of the well after circulating bottoms up at 3350 ft. It was decided to maintain a mud weight of 10.5 #/gal in circulating bottoms up and to drill ahead with this mud weight. Itwas also decided to make MRT runs inside the drill pipe at every stand after drilling recommended. It was planned to plot theMRT data on the temperature graphs and by means of this data to acertain when to run 9 5/8 inch casing.

RETURN TO DAILY DRILLING REPORTS

6/13/91

Ran HLS logs, DLS, GR, GRD, Temperature, logged down to 3325 ft. started to log up HLS tool failed while coming up hole. Re-rigged HLS and ran temperature tool only, tool was run in to 2204 ft. and logging commenced from that depth on down, HLS tool failed at or near well depth of 3325 ft. Pulled out of hole with HLS tool and rigged down lubricator. Picked up bottom hole assembly and ran in hole to top of cement at 3350 ft. Drilled out cement in 12 1/4 inch hole from 3350 ft. to 3401 ft. Drilled out of cement and drilled new formation from 3401 ft. to 3476 ft. Well unloaded, indications to the driller were that pump pressure was increasing and the driller was picking up the Kelly to close the BOP's when the well unloaded.

6/14/91

Attempts were made to kill Well KS-8. (DETAILS ARE LISTED IN ANOTHER PART OF THIS REPORT)

BRIEF OUTLINE OF WELL KILL PROCEDURE.

Picked up on kelly, closed bottom pipe rams,(steel rams). Rams even though closed , leaked steam and water, closed in on top rams and opened on 4 inch kill line. Rigged up on standpipe and closed standpipe valve, pumped water through standpipe and kelly hose with Halliburton, pumped down drill pipe at 9 bbls/minute. Opened up choke line to divert flow from under the rig. Closed choke line pumping 9 bbls/min down drill pipe at 1400 psi. Worked on getting in to bottom of cellar to hook up to 13 3/8 inch casing head valves in order to dead head water into well.

6/15/91

Continued to attempt to kill well, worked in cellar, hooked up to 13 3/8 inch wing valves on casing head. Rigged Halliburton to wing valves, pumped down 13 3/8 inch annulus at 5 bbls/minute with water at 1700 psi, pressure gradually decreased to 1000 psi., concurrently with pumping into annulus pumped down drill pipe with water at 5 bbls/ minute at 900 psi.

6/16/91

Pumped lost circulation material into 13 3/8 inch wing valves in an attempt to seal off around pipe rams and to stop leakage of steam and water around stack. Lost circulation material succeeded in plugging off leaks around pipe rams. Cleared off rig floor, worked toward rig repair. Continued to pump down drill pipe and into casing annulus.

Drill pipe	4 bbls/min	900 psi.
Casing	4 bbls/min	950 psi.

6/17/91

Worked on Parker Drilling Co. mud lines, Changed out top drill pipe rams in BOP stack. Closed top rams on drill pipe, opened bottom set of rams, stack held O.K., Changed over from pumping with Halliburton to pumping with Parker Drilling Co. pumps (rig pumps). Released Haliburton, changed out Hydril rubber. Continued pumping into well.

Drill pipe	4 bbls/min	900 psi.
Casing annulus	4 bbls/min	950 psi.

PUNA GEOTHERMAL VENTURE
ATMOSPHERIC HYDROGEN SULFIDE CONCENTRATION
FIELD DATA SHEET

NO.	DATE	TIME	LOCATION	H2S (ppm)	NOISE (dBa	COMMENTS
01	06-13-91	10:18	Southwest Station	0.29		
		10:20		0.507		
		10:27			95+	
02	06-13-91	10:36	Southeast	0	73	
03	06-13-91	10:46	Leilani/Pohoiki	0.15		
04	06-13-91	10:52	Irvine Residence	0.0835	82	
05	06-13-91	11:05	Leilani/Mohala	0.014		
06	06-13-91	11:10	Mohala/Kahukai	0		
07	06-13-91	11:12	Kaupili/Kahukai	0		
08	06-13-91	11:15	Leilani/Kahukai	0.18		
09	06-13-91	11:19	South end Hinalo	0.103		
10	06-13-91	11:24	Pad E Road Entrance, Gate 2	0		
11	06-13-91	13:19	Southwest Station	0.024	93	
12	06-13-91	13:44	Leilani/Pohoiki	0.055		
13	06-13-91	13:38	Leilani/Kahukai	0.13		
14	06-13-91	13:42	Irvine Residence	0.17		
15	06-13-91	13:46	Mohala/Kahukai	0		
16	06-13-91	13:50	Mohala/Leilani	0.006		
17	06-13-91	13:54	South end Hinalo	0.002		
18	06-13-91	13:59	Pad E Road Entrance, Gate 2	0		
19	06-13-91	16:03	Southwest Station	0.048	85	
		16:08			92	
20	06-13-91	16:15	Southeast Station	0.001	71	
21	06-13-91	16:24	Pohoiki/Leilani	0.045	88	
22	06-13-91	16:29	Leilani/Kahukai	0.021	85	
23	06-13-91	16:32	Irvine Residence	0	90	
24	06-13-91	16:36	Kahukai/Mohala	0	70	
25	06-13-91	16:39	Mohala/Leilani	0	85	
26	06-13-91	16:44	South end of Hinalo	0.04	80	
27	06-13-91	16:48	Hinalo/Pohoiki	0.001	90	
28	06-13-91	16:51	Pad E Entrance Rd., Gate 2	0	78	
29	06-13-91	19:22	Southwest Station	0	87	
30	06-13-91	19:37	Southeast Station	0		
		19:39			91	
31	06-13-91	19:44	Pohoiki/Leilani	0.125	96	
32	06-13-91	19:50	Leilani/Kahukai	0	85	
33	06-13-91	19:58	Irvine Residence		77	
34	06-13-91	20:01	Hinalo/Pohoiki	0.017	92	
35	06-13-91	20:07	Hinalo/Laufne	0	88	
36	06-13-91	10:03	Pohoiki Rd, Laughlin House	0	52	
37	06-13-91	10:10	Southwest Station	0	68.3	
		10:12			90	
38	06-13-91	10:22	Southeast Station	0	81	
39	06-13-91	10:30	Pohoiki/Leilani	0	82	
40	06-13-91	10:33	Pohoiki/Hinalo	0	94	

PUNA GEOTHERMAL VENTURE
ATMOSPHERIC HYDROGEN SULFIDE CONCENTRATION
FIELD DATA SHEET

NO.	DATE	TIME	LOCATION	H2S (ppm)	NOISE (dBa	COMMENTS
41	06-13-91	10:37	3/10 Mi. East of Pohoiki/Hinalo	0.011	76	
42	06-13-91	10:45	8/10 Mi. East of Pohoiki/Hinalo	0	72	
43	06-13-91	10:49	1/2 Mi. East of Pohoiki/Hinalo	0.003	71	
44	06-13-91	10:55	Lauone/Hinalo	0.13	86	
45	06-13-91	11:00	Lauone (Brees #33)	0.125	78	
46	06-14-91	1:13 am	Southwest Station	0	84	
		1:15 am			84	
47	06-14-91	1:27 am	Southeast Station	0.014	78	
		1:29 am			85	
48	06-14-91	1:40 am	Pohoiki/Leilani	0	76	
49	06-14-91	1:43 am	Hinalo/Pohoiki	0	88	
50	06-14-91	1:46 am	1/2 Mi. East of Hinalo/Pohoiki	0.092	70	
51	06-14-91	1:52 am	8/10 Mi. East of Hinalo/Pohoik	0	78	
52	06-14-91	1:58 am	Lauone/Hinalo	0.2	86	
53	06-14-91	2:02 am	Lauone (Brees #33)	0.034	77	
54	06-14-91	2:08 am	Hinalo...End	0	72	
55	06-14-91	2:14 am	Hinalo 500 yrds from Pohoiki	0.002	85	
56	06-14-91	2:20 am	Irvine Residence	0	78	
57	06-14-91	4:11 am	Laughlin Residence, Pohoiki	0	70	
58	06-14-91	4:17 am	Southwest Station	0.001	80	
		4:19 am			80	
59	06-14-91	4:28 am	Southeast Station	0.001	80	
		4:30 am			79.6	
60	06-14-91	4:36 am	Pohoiki/Leilani	0.001	89	
61	06-14-91	4:40 am	Hinalo/Pohoiki	0.007	99	
62	06-14-91	4:44 am	1/2 Mi. East of Hinalo/Pohoiki	0	88	
63	06-14-91	4:50 am	AGR	0.012	75	
64	06-14-91	5:00 am	Hinalo 500 yds from Pohoiki	0.024	94	
65	06-14-91	5:05 am	Lauone/Hinalo	0.11	83	
66	06-14-91	5:07 am	Lauone (Brees #33)	0.001	79	
67	06-14-91	5:10 am	Irvine Residence	0	84	
68	06-14-91	17:28 pm	Pad E Road Entrance, Gate 2	0		
69	06-14-91	1500-				
		1600 pm	Southwest Station	0.017		Hourly Average
70	06-14-91	1600-				
		1700 pm	Southwest Station	0.000		Hourly Average
71	06-14-91	17:37 pm	Gate 3 (#GPA)	0.028		
72	06-14-91	17:38 pm	Gate 3	0		
73	06-14-91	1400-				
		1500 pm	Southeast Station	0		Hourly Average
74	06-14-91	1500-				
		1600 pm	Southeast Station	0		Hourly Average
75	06-14-91	1600-				
		1700 pm	Southeast Station	0		Hourly Average
76	06-14-91	17:47 pm	HGPA Parking Lot	0.170		

PUNA GEOTHERMAL VENTURE
ATMOSPHERIC HYDROGEN SULFIDE CONCENTRATION
FIELD DATA SHEET

NO.	DATE	TIME	LOCATION	H2S (ppm)	NOISE (dBa	COMMENTS
77	06-14-91	17:50 pm	Pohoiki/Leilani	0.011		
78	06-14-91	17:53 pm	Irvine Residence	0.057		
79	06-14-91	17:53 pm	Robert Petricci Residence			
80	06-14-91	17:53 pm	Kahukai/Kaupili	0		
81	06-14-91	18:00 pm	Hill near Irvine Residence	0.057		
82	06-14-91	18:02 pm	Pohoiki/Hinalo	0		
83	06-14-91	18:04 pm	Hinalo/Lauone	0		
84	06-14-91	18:27 pm	Martinovich at Gate	0		
85	06-14-91	18:10 pm	Pohoiki between Leilani	0.042		
86	06-14-91	21:49 pm	Power Plant	0		
87	06-14-91	21:57 pm	600' West of KS-8	0.270		Directly Downwind
88	06-14-91	22:02 pm	Southeast Station	0		
89	06-14-91	22:07 pm	West end of Pad E	0.190		Downwind
90	06-14-91	22:17 pm	Pohoiki/Kapoho Road	0		
91	06-14-91	22:22 pm	Gate 2	0		
92	06-14-91	22:27 pm	HGPA Parking Log North end	0.130		Downwind
93	06-14-91	22:30 pm	Leilani/Pohoiki	0.280		
94	06-14-91	22:33 pm	Pohoiki/Hinalo	0		
95	06-14-91	22:37 pm	Wilson Residence, Hinalo9	0		
96	06-14-91	22:40 pm	Irvine Residence	0.057		Downwind
97	06-14-91	22:43 pm	Robert Petricci Residence	0		
98	06-14-91	22:51 pm	Mohala 0.3 Mi. N. of Leilani	0.083		
99	06-14-91	22:59 pm	Kaupili 0.2 Mi. N. of Leilani	0.082		Downwind
100	06-14-91	1:12 am	Kapoho/Pohoiki	0		
101	06-14-91	1:16 am	KGPA Parking Lot	0		
102	06-14-91	1:20 am	Pohoiki/Leilani	0.108		
103	06-14-91	1:24 am	Pohoiki/Hinalo	0		
104	06-14-91	1:25 am	Hinalo/Lauone	0		
105	06-14-91	1:27 am	West end Hinalo	0.016		
106	06-14-91	1:33 am	Irvine Residence	0		
107	06-14-91	1:35 am	Leilani/Kahukai	0.011		
108	06-14-91	1:39 am	Leilani, Kaupili	0		
109	06-14-91	1:42 am	Leilani between Kahukai and			
			and Mohala	0.006		
110	06-15-91	4:43 am	PGV Gate 1	0		No Wind
111	06-15-91	4:48 am	PGV Gate 2	0		No Wind
112	06-15-91	4:53 am	HGPA Parking Lot	0		No Wind
113	06-15-91	4:57 am	100' South East Pohoiki/Leilar	0.038		No Wind, low area
114	06-15-91	4:59 am	Hinalo/Pohoiki	0.014		No Wind, low area
115	06-15-91	5:03 am	300' East Hinalo/Pohoiki	0.001		No Wind, low area
116	06-15-91	5:08 am	HI. AG. Station/Pohoiki Road	0		No Wind, Trees
117	06-15-91	5:15 am	Hinalo/Lauone	0.052		Downwind
118	06-15-91	5:18 am	Lauone/Leary Residence	0		Light Wind
119	06-15-91	5:25 am	Top of Hinalo	0.046		Light Wind
120	06-15-91	5:29 am	Hinalo/Wilson Residence	0.003		Light Wind

PUNA GEOTHERMAL VENTURE
ATMOSPHERIC HYDROGEN SULFIDE CONCENTRATION
FIELD DATA SHEET

NO.	DATE	TIME	LOCATION	H2S (ppm)	NOISE (dBa	COMMENTS
121	06-15-91	5:00 am	Leilani/Kahukai	0		Light Wind
122	06-15-91	5:30 am	Kapoho/Pohoiki	0		Light Wind
123	06-15-91	5:32 am	PGV Gate 2	0.001		Downwind/Trees
124	06-15-91	6:34 am	Pohoiki/Leilani	0		Downwind/Trees
125	06-15-91	6:36 am	Pohoiki/Hinalo	0.120		Downwind
126	06-15-91	6:40 am	Pohoiki Road/HI.AG. Station	0.001		No Wind/Trees
127	06-15-91	6:43 am	Hinalo/Lauone	0.001		Light Wind
128	06-15-91	6:46 am	Lauone/Leary Residence	0		Light Wind
129	06-15-91	6:50 am	Top of Hinalo	0.041		Light Wind
130	06-15-91	6:55 am	Hinalo/Wilson Residence	0.034		Downwind
131	06-15-91	7:00 am	Kahukai/Irvine Residence	0.001		Light Wind
132	06-15-91	7:03 am	Kahukai/Petricci Residence	0		Light Wind
133	06-15-91	7:06 am	Hookupu/Marzl Residence	0		Light Wind
134	06-15-91	7:15 am	Hookupu/Leilani	0		Light Wind
135	06-15-91	7:20 am	Hookupu/Malama	0		Light Wind

PUNA GEOTHERMAL VENTURE - CONSTRUCTION

P.O. BOX 1337, HILO, HI 96721-1337
TEL: (808) 961-2786 FAX: (808) 935-5562

FACSIMILE COVER PAGE

SENT TO: DLNR MSG #: 3173

ATTENTION: Mr. Manabu Tagamori FAX #: 548-6052

FROM: Thomas G. Kizlik DATE: 6-18-91

FILE #: _____ CC: Mr. Dean Nakano

NUMBER OF PAGES (INCLUDING COVER SHEET): 15

IF YOU HAVE DIFFICULTIES RECEIVING THIS FAX PLEASE CALL (808) 961-2786 ASK FOR: Cheryl.

Copy to follow via 1st class mail.

MEMORANDUM

TO: Dr. John Lewin, Director

FROM: Thomas G. Kizis TGK

DATE: June 19, 1991

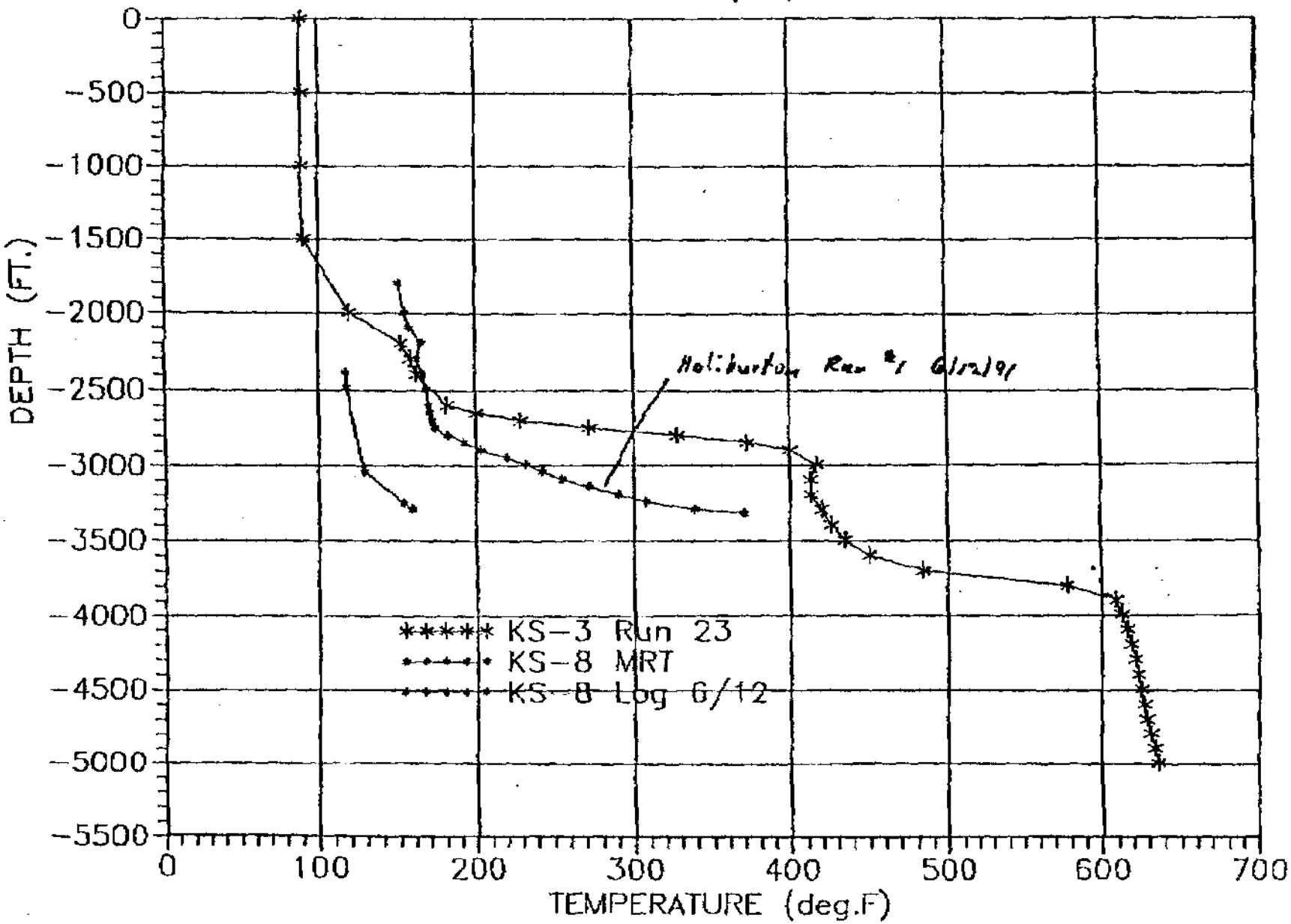
SUBJ: REPORT DATED JUNE 17, 1991

****

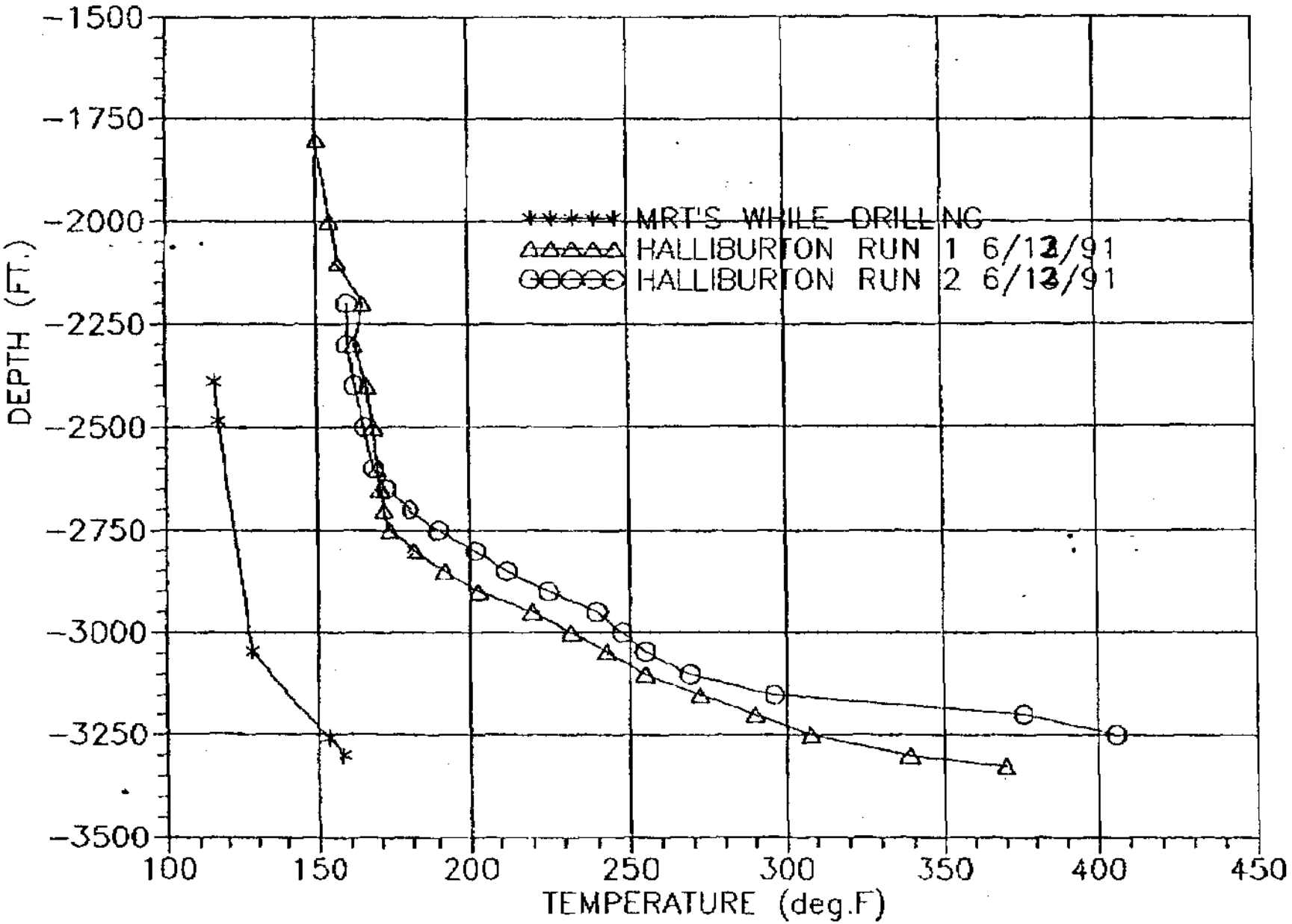
According to the 9th page of the Report on Uncontrolled Flow Event as per Conditions #13 and #26, in the Appendix section dated 6/12/91, paragraph two (2), the attached two graphs are part of the report.

cc: W. Paty, DLNR
M. Tagamori, DLNR
D. Nakano, DLNR
E. Tanaka, DLNR
N. Hayashi, HCPD
C. Hew, DOH
N. Hirai, DLNR
B. Clark, PGV
B. Teplow
File: 7.13.2, 14.3.13, 14.3.26

PUNA GEOTHERMAL VENTURE
KS-3: TEMPERATURE VS DEPTH
PRUETT RUN 23, 6/5/91



PUNA GEOTHERMAL VENTURE
KAPOHO STATE 8
SUBSURFACE TEMPERATURE DATA



PUNA GEOTHERMAL VENTURE - CONSTRUCTION

P.O. BOX 1337, HILO, HI 96721-1337
TEL: (808) 961-2786 FAX: (808) 935-5562

FACSIMILE COVER PAGE

SENT TO: DLNR MSG #: 3191

ATTENTION: Ms. Marsha Sagamori FAX #: 548-6052

FROM: Sherman J. Kijek DATE: 6-19-91

FILE #: _____ CC: Mr. Dean Nakano

NUMBER OF PAGES (INCLUDING COVER SHEET): #4

IF YOU HAVE DIFFICULTIES RECEIVING THIS FAX PLEASE CALL (808) 961-2786 ASK FOR: Cheryl.

PUNA GEOTHERMAL VENTURE

A Hawaii Partnership

March 5, 1992

Dr. John Lewin, M.D.
Director
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, Hawaii 96801

Dear Dr. Lewin:

Subject: Puna Geothermal Venture
Authority to Construct Permit No. A-833-975

Pursuant to Special Condition No. 29 of the subject document, Puna Geothermal Venture (PGV) respectfully submits the PGV Aerosol Test Plan for your review and approval. PGV believes this program outlines a comprehensive and thorough plan which fulfills the department's requirements of special condition number 29.

The Aerosol Test Plan incorrectly bling permit number as A-834-796 w 1991. The correct document January 13, 1992. We hope th inconvenience or delay the re

If there are any questions reg el free to contact me in the Hilo

Sincerely,

Maurice A. Richard
Vice President
Puna Geothermal Venture

Enclosure

cc:
P. Aki, DOH
B. Paty, DLNR
R. Nakano, HCPD
J. Swift, DLNR

DOH - PGV Prod. Well Special Condition # 29 A-833-975 3-5-92

92036.011

PGV Aerosol Test Plan
HDOH Special Condition No. 29

Prepared for
Puna Geothermal Venture

by
Thermochem, Inc.
5347 Skylane Blvd.
Santa Rosa, CA 95403

February 21, 1992

Table of Contents

PGV Aerosol Test Plan
HDOH Special Condition No. 29

1.0 Introduction

This test plan is intended to meet the Hawaii Department of Health (HDOH) requirements for particulate and aerosol emissions monitoring during the well clean-out and flow testing operations for the Puna Geothermal Venture (PGV) well KS-8 (condition 29). This special condition was added to ATC No. A-834-796 December 9, 1991. The condition specifies that PGV shall "physically and chemically characterize the particulate and aerosol emissions and corresponding ambient concentration from these operations." For the purposes of this test plan, the condition is interpreted to mean that atmospheric steam releases resulting from the operations described above must be source tested for all potentially toxic particulate and aerosol phase inorganic constituents that may be present in the produced geothermal fluid, including the chemical species listed in the original ATC permit. The term "source test" refers to quantification of constituent concentrations and mass emission rates at the emission source point. In addition to the source testing, ambient air monitoring near the zone of maximum impact for the same constituents in respirable form (PM10) is assumed to be required during the steam release operations.

2.0 KS-8 Clean-Out Operation

The initial well clean-out operation will involve full flow of KS-8 to the Pad D vent muffler for a maximum duration of 4 hours. The expected steam flow rate at atmospheric flash during this operation is between 250 and 400 KPH (1000 lbs/hr). Sodium hydroxide and water will be injected upstream of the muffler for H_2S abatement. All brine, particulate, and residual H_2S abatement fluids will be discharged to the vent muffler, the bulk of which will be separated from the vapor phase by the inertial cyclone action of the muffler and drained to the Pad D sump. The muffler stack dimensions are 15 feet in diameter and 20 feet in height, resulting in exit velocities of 10.5 to 16.9 ft/scc at the anticipated flowrates. The steam will be saturated at a temperature of approximately 212°F.

2.1 Emission Source Test

Source testing will be conducted during the well clean-out operation to quantitate the concentrations and emission rates of total particulate matter and specific inorganic constituents. The stack samples will be collected as close as possible to isokinetic sampling rates, given the expected variability in vent flowrates. Since the well vent operation is limited to 4 hours, the steam flow- rate may not approach steady-state conditions, making it very difficult to maintain precise isokinetic sampling rates. Cyclonic flow conditions may also limit the sampling accuracy.

Isokinetic sampling, where velocities through the sample nozzle match stack velocities at the sample point, are required to obtain representative samples of particulate, droplets and aerosols relative to the bulk vapor phase. Precise isokinetic sampling is critical for particles above 10 um, and becomes less important at smaller size ranges. Very fine particles (< 1 um) tend to follow gas stream lines in the flow and are not disrupted by the presence of a sample nozzle.

Three sample ports for the source test probes will be installed 5 feet below the top lip of the vent muffler, off-set 120° apart (see diagram 2-1). The probes will be traversed across the stack diameter at points of cross-sectional equal area (EPA method 1) to the maximum extent possible during the clean-out duration.

Stack velocities will be estimated from the two-phase discharge tube lip pressure measurements (James-tube) and direct velocity pressure measurements within the stack (S-type pitot tube) during the clean-out operation.

2.1.1 Cascade Impactor Test

During the well clean-out, a potential exists for the emission of solid particulate matter such as formation material (rock dust), cement, drilling mud and casing corrosion products. A cascade impactor collection train will be utilized during this operation to obtain samples primarily of solid particulate matter. The sample probe liner and cascade impactor device will

be heated to 350°F to evaporate liquid droplets and aerosols, thereby allowing the bulk of this material to be collected as solid particulate also.

The cascade impactor is a routine particulate source test device that separates particles by size range during collection through inertial separation and impaction. The impactor to be used for the KS-8 test contains 6 particulate sizing stages. The size distributions will be verified by scanning electron microscopy (SEM) of each collection stage after the test. Qualitative chemical and mineralogical composition data will also be obtained from the SEM scans by X-ray microprobe analysis.

Table 2-1 lists the approximate particle size ranges and mass detection limits for each impactor stage based on a total of 2 hours collection time.

The complete cascade impactor source test will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Initial constant weight of Teflon impactor substrates
2.0 Caliper gauge measurement of isokinetic nozzle diameters
3.0 Calibration curve for critical flow Venturi flow meter
4.0 Calibration curve for probe liner and impactor outlet thermocouples
5.0 Calibration curve for Venturi vacuum gauges
6.0 Caliper gauge measurement of S-type pitot tube dimensions
7.0 Calibration curve for pitot tube differential pressure (D.P.) gauges
8.0 Calibration curve for stack temperature thermocouple
9.0 Equal area traverse point lay-out
10.0 On-site barometric pressure
11.0 On-site leak test of impactor sample train
12.0 On-site leak test of pitot tube/D.P. gauge instrumentation

SOURCE TEST DATA COLLECTION

1.0 Traverse point location, clock time
2.0 Stack temperature (5 minute intervals)
3.0 Stack velocity, D.P. gauge (2 minute intervals)
4.0 James-tube lip pressure (5 minute intervals)
5.0 Venturi flow meter vacuum, upstream/downstream (2 minute intervals)
6.0 Probe liner and impactor outlet temperatures (5 minute intervals)

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final leak test of impactor sample train (on-site)
2.0 Final leak test of pitot tube/D.P. gauge instrumentation (on-site)
3.0 On-site barometric pressure
4.0 Total sample computed mass and volume
5.0 Stack velocities and average computed volumetric/mass flowrates
6.0 Mass flowrate estimates based on James-tube measurements
7.0 Average % isokinetic sampling rate
8.0 Caliper gauge check of isokinetic nozzle diameters
9.0 Calibration check of critical flow Venturi flow meter
10.0 Calibration check of probe liner and impactor outlet thermocouples
11.0 Calibration check of Venturi vacuum gauges
12.0 Caliper gauge check of S-type pitot tube dimensions
13.0 Calibration check of pitot tube differential pressure (D.P.) gauges
14.0 Calibration check of stack temperature thermocouple

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Final constant weight of Teflon impactor substrates
2.0 Particulate concentration at each impactor stage (mg/Kg , mg/m^3)
3.0 Total mass emission rate of particulate matter (Kg/hr)
4.0 Particle size distribution for each impactor stage (SEM)
5.0 Qualitative elemental and mineralogical composition of particulate (SEM)

Table 2-1 Cascade Impactor Detection Limits

Impactor Stage	Particle Size Range Minimum	Maximum	Detection Limit mg/Kg	mg/m3
1	10	---	0.095	0.059
2	3.8	10	0.095	0.059
3	1.8	3.8	0.095	0.059
4	1.0	1.8	0.095	0.059
5	0.50	1.0	0.095	0.059
6	0.25	0.50	0.095	0.059

Note: Detection limit based on 2 hrs. collection time.
Particle size ranges are estimated from D50 curves and will be verified by SEM analysis.

2.1.2 Impinger Train Test

The quantification of potentially toxic metals and other inorganic constituents will be performed by utilizing a modified EPA Combined Metals Train source test procedure. These tests will allow isokinetic collection of samples for analysis of total quantities of each constituent regardless of phase or size distribution.

Steam samples from the isokinetic probe will be condensed and trapped in a series of 3 impinger bottles containing an H_2O_2/HNO_3 solution for total metals analysis and $K_2Cr_2O_7/HNO_3$ solution for total mercury analysis. Samples for other inorganic constituents such as anions, boron and silica will be collected in a series of 3 impinger bottles containing deionized water (D.I.).

Samples collected in H_2O_2/HNO_3 solutions will be digested for total metals and analyzed by Inductively Coupled Argon Plasma Emission Spectroscopy (ICP) and Graphite Furnace Atomic Absorption (GFAA). Samples collected in $K_2Cr_2O_7/HNO_3$ solutions will be analyzed by Cold Vapor Atomic Absorption (CVAA) for total mercury. The samples collected in D.I. water impingers will be analyzed by ion chromatography (IC), wet chemical techniques or ICP, and Flame Atomic Absorption (FAA).

Each impinger bottle from each collection train will be analyzed separately to verify trapping efficiencies of the various analytes. High purity reagents (Ultrex grade) will be used in the impinger bottles and complete sets of sample train blanks will be collected before each test.

The D.I. water train samples will be analyzed for major species present in the discharge liquid phase (brine and abatement products) such as sodium, potassium and chloride, in addition to the other species. These constituents will be used as tracer species to calculate the quantity of liquid entrained in the vented steam and the amount of total dissolved solids emitted based on the discharge water analysis.

Table 2-2 lists the constituents to be analyzed in each train and their respective detection limits in terms of concentration and mass emission rate.

The complete impinger train source test will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Initial weights and solution volumes for each impinger bottle
2.0 Caliper gauge measurement of isokinetic nozzle diameters
3.0 Calibration curve for Dry Gas Test Meter (DGM)
4.0 Calibration check of field balance for impinger weights
5.0 Calibration curve for impinger train vacuum gauge
6.0 Calibration curve for impinger and DGM thermocouples
7.0 Caliper gauge measurement of S-type pitot tube dimensions
8.0 Calibration curve for pitot tube differential pressure (D.P.) gauges
9.0 Calibration curve for stack temperature thermocouple
10.0 Equal area traverse point lay-out
11.0 On-site barometric pressure
12.0 On-site leak test of impinger sample train
13.0 On-site leak test of pitot tube/D.P. gauge instrumentation
14.0 Initial DGM volume reading

SOURCE TEST DATA COLLECTION

1.0 Traverse point location, clock time
2.0 Stack temperature (5 minute intervals)
3.0 Stack velocity, D.P. gauge (2 minute intervals)
4.0 James-tube lip pressure (5 minute intervals)
5.0 Impinger and DGM temperature (5 minute intervals)
6.0 Impinger train vacuum (5 minute intervals)
7.0 Noncondensible gas flowrates, DGM (5 minute intervals)
8.0 Relative weight change of impinger bottles (5 minute intervals)

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final DGM volume reading, total noncondensible gas volume
2.0 Final leak test of impinger sample train (on-site)
3.0 Final leak test of pitot tube/D.P. gauge instrumentation (on-site)
4.0 On-site barometric pressure
5.0 Final impinger weights, total sample mass
6.0 Stack velocities and average computed volumetric/mass flowrates
7.0 Mass flowrate estimates based on James-tube measurements
8.0 Average % isokinetic sampling rate
9.0 Calibration check of Dry Gas Test Meter (DGM)
10.0 Calibration check of field balance for impinger weights
11.0 Calibration check of impinger train vacuum gauge
12.0 Calibration check of impinger and DGM thermocouples
13.0 Caliper gauge check of isokinetic nozzle diameters
14.0 Caliper gauge check of S-type pitot tube dimensions
15.0 Calibration check of pitot tube differential pressure (D.P.) gauges
16.0 Calibration check of stack temperature thermocouple

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Complete chemical analysis of each impinger solution (see table 2-2)
2.0 Total ug of analyte in each impinger bottle
3.0 Total concentration of each analyte (ug/Kg , ug/m^3)
4.0 Total mass emission rate of each analyte (g/hr)

Table 2-2 Impinger Train Detection Limits KS-8 Clean-out Operation

Analyte	Impinger Solution	Method	Detection Limit ug/Kg	Detection Limit ug/m3	Emission rate, lbs/hr @ 400 KPH Steam
MERCURY	K2Cr2O7/HNO3	CVAA	0.60	0.36	2.40E-04
ARSENIC	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
LEAD	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
IRON	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
MANGANESE	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
ZINC	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
BARIUM	H2O2/HNO3	GFAA	2.5	1.5	1.00E-03
CADMIUM	H2O2/HNO3	GFAA	0.50	0.30	2.00E-04
COPPER	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
CHROMIUM	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
NICKEL	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
SELENIUM	H2O2/HNO3	GFAA	1.3	0.78	5.20E-04
VANADIUM	H2O2/HNO3	GFAA	6.5	3.9	2.60E-03
SODIUM	D.I. Water	FAA	5	3.0	2.00E-03
POTASSIUM	D.I. Water	FAA	20	12	8.00E-03
BORON	D.I. Water	ICP	20	12	8.00E-03
CHLORIDE	D.I. Water	IC	25	15	1.00E-02
FLUORIDE	D.I. Water	IC	25	15	1.00E-02

Detection limit concentrations are relative to steam by mass (ug/Kg) and volume at 14.72 psia (ug/m3).

2.2 Ambient Air Monitoring

During the well clean-out operation, ambient air samples will be collected for total particulate matter, including aerosols, equal to or less than 10 microns in size (PM10). The PM10 size fraction will be collected since the primary area of concern is the ambient air impact of toxic respirable particles and total respirable particulate matter. Standard high-volume air samplers fitted with PM10 heads will be employed during the test.

The air samplers will be started 1 hour before the clean-out operation begins and shut-down 1 hour after steam venting is ceased from the Pad D vent muffler. The PM10 sampler air flowrates will be approximately 1.3 m^3/minute (46 CFM).

A total of 5 PM10 monitoring stations will be in operation during the well clean-out, with 1 station located upwind, 3 stations in separate downwind locations and 1 co-located downwind station (duplicate sampler). The station positions were determined on the basis of wind speed and direction data for the PGV site, collected in 1981 to 1982, and atmospheric dispersion modeling (ISCST) performed specifically for the emission source. The daytime wind rose was used to determine the highest probability wind direction during the clean-out operation, which will occur during daytime hours. The downwind stations will be located within the predicted zone of maximum plume impact based on the dispersion modeling results and the daytime wind rose. Station placement was also restricted by the availability of electrical power and site security, which limited sampling locations to the PGV project area or existing air monitoring stations.

The single upwind station will be located at the "Woods" air quality monitoring site, approximately 7,600 feet northwest of PGV Pad A. This site should receive minimal impact from the steam venting operations while being in close enough proximity to provide a reasonable representation of background concentrations in the impact monitoring zone.
The PM10 station positions are shown in diagram 2-2.

Meteorological data will be collected continuously at the PGV site (2 MET stations) during the flow event for estimation of the time-weighted exposure of each monitor to the plume and correction of measured concentrations to exposure times, if desired.

2.2.1 PM10 Filter Analysis

High purity quartz fiber filters will be used in the PM10 monitors to minimize background levels of analytes. Three blank filters from each lot will be analyzed for all target elements prior to the test and at least 3 blank filters will be analyzed with each set of samples.

All sample filters will be weighed before and after collection (at constant humidity) for gravimetric determination of total PM10.

Filter strips will be digested by the EPA recommended microwave extraction procedure and analyzed by Inductively Coupled Argon Plasma Emission Spectroscopy (ICP), Graphite Furnace Atomic Absorption (GFAA), and Cold Vapor Atomic Absorption (CVAA) for all metals analyses.

Additional filter sections will be ultrasonic bath/D.I. water extracted for anion and ammonium analyses by ion-chromatography and flow injection analysis techniques.

Table 2-3 lists the constituents to be analyzed and their approximate detection limits based on a 6-hour sampling period.

The complete ambient air monitoring tests will involve the collection and generation of the following data:

PRE-TEST PARAMETERS

1.0 Background determination of analytes in filter lots
2.0 Physical inspection of filters for imperfections
3.0 Initial filter weights at constant humidity
4.0 Calibration curve for high-volume flow meter
5.0 Initial flowrate check with filter installed (must be 1.1 to 1.7 m^3/minute)
6.0 Barometric pressure and ambient temperature (recorded at MET station)
7.0 Start/stop timer set-points for sampler and flow recorder
8.0 Sampler I.D., site location, filter I.D., date

POST-TEST PARAMETERS AND COMPUTATIONS

1.0 Final flowrate check for sampler (re-start for 5 minutes)
2.0 Barometric pressure and ambient temperature (recorded at MET station)
3.0 Filter condition and I.D. number
4.0 Elapsed and stop times for sampler
5.0 Indicated total sample volume
6.0 Computed actual volume at standard conditions
7.0 Calibration check for high-volume flow meter
8.0 Data recovery from MET stations

LABORATORY MEASUREMENTS AND FINAL RESULTS

1.0 Final filter weight at constant humidity
2.0 Total concentration of PM10 (ug/m^3)
3.0 Complete chemical analysis of sections from each filter (see table 2-3)
4.0 Total concentration of each analyte (ug/m^3)
5.0 Corrected concentrations to time weighted plume exposures

Table 2-3 PM10 Monitor Detection Limits KS-8 Clean-out Operation

Analyte	Method	Detection Limit Total ug	ug/m3
ARSENIC	GFAA	0.5	0.0011
LEAD	GFAA	0.5	0.0011
IRON	ICP	5.0	0.011
MANGANESE	ICP	1.0	0.0021
ZINC	ICP	2.5	0.0053
BARIUM	ICP	1.0	0.0021
CADMIUM	ICP	2.0	0.0043
COPPER	ICP	2.0	0.0043
CHROMIUM	ICP	5.0	0.011
NICKEL	ICP	7.5	0.016
SELENIUM	GFAA	1.0	0.0021
VANADIUM	ICP	5.0	0.011
SODIUM	FAA	2.5	0.0053
POTASSIUM	FAA	10.0	0.021
CHLORIDE	IC	10.0	0.021
FLUORIDE	IC	10.0	0.021
Total PM10	Gravimetric	100	0.2

Detection limit concentrations are based on sampler flowrate of 1.3 m3/min and sampling interval of 6 hr.

3.0 KS-8 Flow Test

The 10-day flow test of KS-8 will involve steam flow up to 200 KPH or the maximum rate possible without exceeding the 5 lbs/hr H_2S emission limit. The two-phase well flow will be diverted from the Pad D vent muffler after clean-out to the Pad A high pressure separator which will operate at approximately 210 psig. The separated brine will flow into a second separator for a final low pressure flash before discharge to a rock pit. The low-pressure steam will combine with the high-pressure steam downstream of the high-pressure steam flow control valve in a final run of 16-inch pipe. Sodium hydroxide and water will be injected into the combined steam flow for H_2S abatement (see diagram 3-1).

This abated steam flow will be vented primarily from the Pad A in-ground rock muffler that has overall dimensions of approximately 100 ft. long by 40 ft. wide and 10 ft. deep. The steam and residual abatement chemicals will discharge to the center of a 30 in. diameter slotted pipe running 40 ft. axially beneath the rocks to diffuse the steam flow.

A portion of the abated steam flow will be diverted from the 16-inch pipeline immediately upstream of the in-ground rock muffler, through a 10-inch gate valve and pipeline to an above-ground vent muffler. This Pad A vent muffler is located adjacent to the in-ground rock muffler and measures 8 feet in diameter and 20 feet in height. The diverted steam flowrate to the vent muffler will range from 50 to 75 KPH, generating stack velocities of 7.4 to 11.1 ft/sec. The steam will be saturated at a temperature of approximately 212°F.

The diversion of steam and entrained abatement chemicals to the above-ground vent muffler will be necessary to obtain aerosol samples under known flow conditions. Isokinetic sampling and standardized sampling protocol can not be employed directly at the in-ground rock muffler, given the lack of a defined cross-sectional flow area and extremely variable velocity profiles. The steam flowrate through the Pad A vent muffler will be much more stable than the flow through the Pad D muffler (well clean-out operation), but similar complications due to cyclonic flow may still exist. The Pad A vent muffler will be partially filled with rock to simulate the in-ground rock muffler as closely as possible.

3.1 Emission Source Test

Source testing will be conducted during the KS-8 flow test to quantitate the concentrations and emission rates of specific inorganic constituents. These tests will be performed during the first half of the flow test, at periods when the well flow is near the maximum allowable rate. The flow test operation only involves the potential for emissions due to incomplete separation of steam from brine and abatement chemicals (liquid droplets and aerosols). The impinger train method will be sufficient to quantitate these emissions in terms of potentially toxic metals and total solids. The cascade impactor method will not be applicable due to the expected low concentration of solid particulate matter in the vapor phase.

Three sample ports for the source test probe will be installed 5 feet below the top lip of the vent muffler, off-set 120° apart (see diagram 3-2). The probe will be traversed across the stack diameter at points of cross-sectional equal area (EPA method 1) during the tests.

Stack velocities will be determined by direct velocity pressure measurements within the stack using an S-type pitot tube during the source tests.

3.1.1 Impinger Train Test

The quantification of potentially toxic metals and other inorganic constituents will be performed by utilizing a modified EPA Combined Metals Train source test procedure. These tests will allow isokinetic collection of samples for analysis of total quantities of each constituent regardless of phase or size distribution.

These impinger train tests will be conducted in exactly the same manner as the well clean-out impinger source tests (section 2.1.2). A total of 3 source tests including each impinger train type will be conducted during the flow test operation.

Table 3-1 lists the constituents to be analyzed in each train and their respective detection limits in terms of concentration and mass emission rate.

Table 3-1 Impinger Train Detection Limits
KS-8 Flow-Test Operation

Analyte	Impinger Solution	Method	Detection Limit ug/Kg	Detection Limit ug/m3	Emission rate, lbs/hr @ 200 KPH Steam
MERCURY	K2Cr2O7/HNO3	CVAA	0.60	0.36	1.20E-04
ARSENIC	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
LEAD	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
IRON	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
MANGANESE	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
ZINC	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
BARIUM	H2O2/HNO3	GFAA	2.5	1.5	5.00E-04
CADMIUM	H2O2/HNO3	GFAA	0.50	0.30	1.00E-04
COPPER	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
CHROMIUM	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
NICKEL	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
SELENIUM	H2O2/HNO3	GFAA	1.3	0.78	2.60E-04
VANADIUM	H2O2/HNO3	GFAA	6.5	3.9	1.30E-03
SODIUM	D.I. Water	FAA	5	3.0	1.00E-03
POTASSIUM	D.I. Water	FAA	20	12	4.00E-03
BORON	D.I. Water	ICP	20	12	4.00E-03
CHLORIDE	D.I. Water	IC	25	15	5.00E-03
FLUORIDE	D.I. Water	IC	25	15	5.00E-03

Detection limit concentrations are relative to steam by mass (ug/Kg) and volume at 14.72 psia (ug/m3).

3.2 Ambient Air Monitoring

During the entire flow test operation, ambient air samples will be collected for total particulate matter, including aerosols, equal to or less than 10 microns in size (PM10). Standard high-volume air samplers fitted with PM10 heads will be employed during the test.

The air samplers will be started at noon each day and shut-down the following day at noon. Each PM10 monitor will collect one 24 hr. (± 1 hr.) integrated sample per day of the flow test. The PM10 sampler air flowrates will be approximately 1.3 m^3/minute (46 CFM).

A total of 5 PM10 monitoring stations will be in operation during the well flow test, with 1 station located upwind, 3 stations in separate downwind locations and 1 co-located downwind station. The initial station positions will remain the same as selected for the well clean-out operation, as described in section 2.2 (diagram 2-2). The stations may be re-located during the flow test to maximize exposure to the plume based on the current meteorological data.

Meteorological data will be collected continuously at the PGV site (2 MET stations) during the flow test for estimation of the time-weighted exposure of each monitor to the plume and correction of measured concentrations to exposure times, if desired.

The PM10 monitors will be operated in exactly the same manner as during the well clean-out operation, with the exception of the longer run time.

3.2.1 PM10 Filter Analysis

The PM10 filter analysis procedure will be identical to the well clean-out test procedures and the same data collection and quality control protocol will be employed (section 2.2.1.).

Table 3-2 lists the constituents to be analyzed and their approximate detection limits based on a 24-hour sampling period.

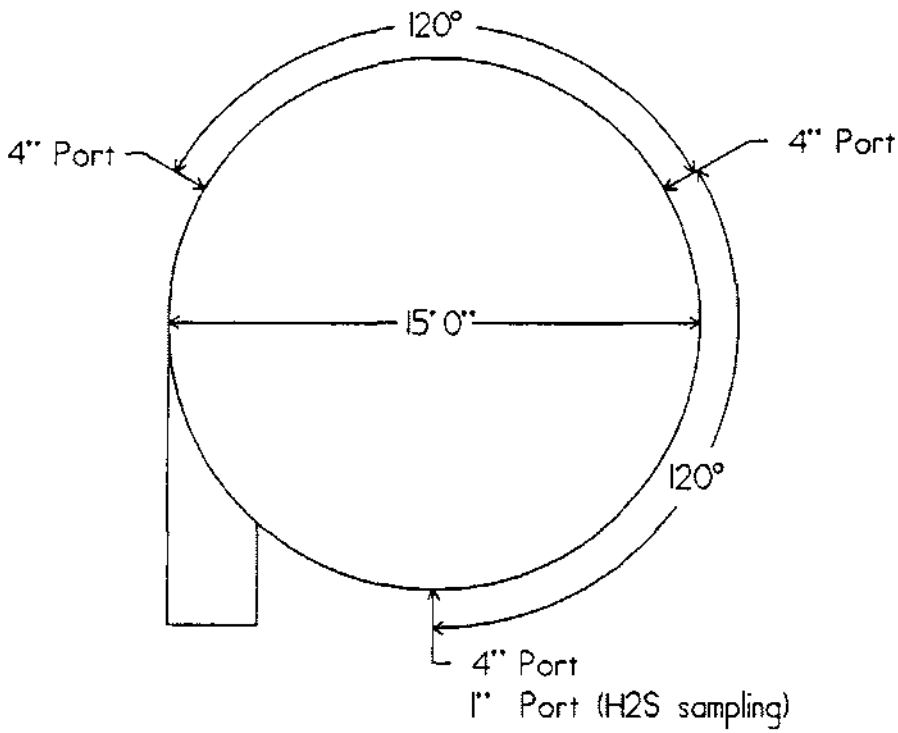
Table 3-2 PM10 Monitor Detection Limits
KS-8 Flow Test Operation

Analyte	Method	Detection Limit Total ug	Detection Limit ug/m3
ARSENIC	GFAA	0.5	0.0003
LEAD	GFAA	0.5	0.0003
IRON	ICP	5.0	0.0027
MANGANESE	ICP	1.0	0.0005
ZINC	ICP	2.5	0.0013
BARIUM	ICP	1.0	0.0005
CADMIUM	ICP	2.0	0.0011
COPPER	ICP	2.0	0.0011
CHROMIUM	ICP	5.0	0.0027
NICKEL	ICP	7.5	0.0040
SELENIUM	GFAA	1.0	0.0005
VANADIUM	ICP	5.0	0.0027
SODIUM	FAA	2.5	0.0013
POTASSIUM	FAA	10.0	0.0053
CHLORIDE	IC	10.0	0.0053
FLUORIDE	IC	10.0	0.0053
Total PM10	Gravimetric	100	0.05

Detection limit concentrations are based on sampler flowrate of 1.3 m3/min and sampling interval of 24 hr.

Appendix I

Diagrams



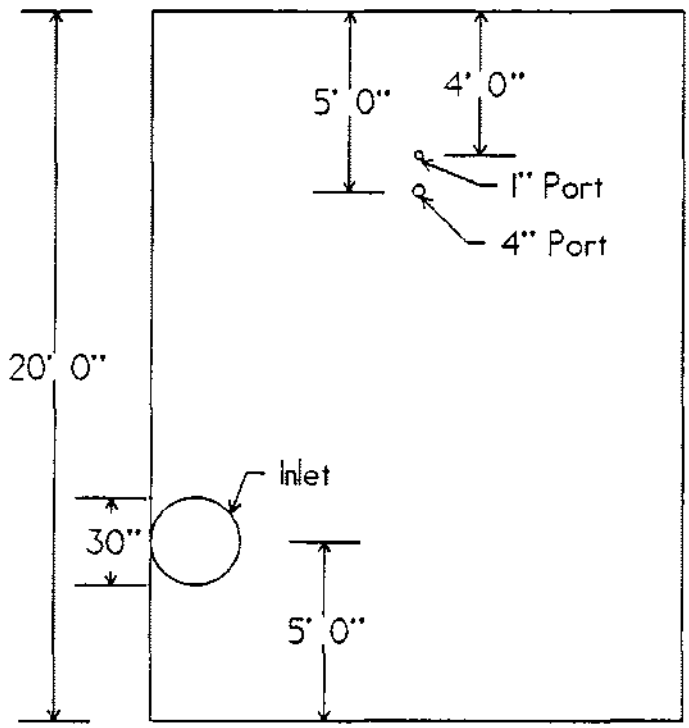
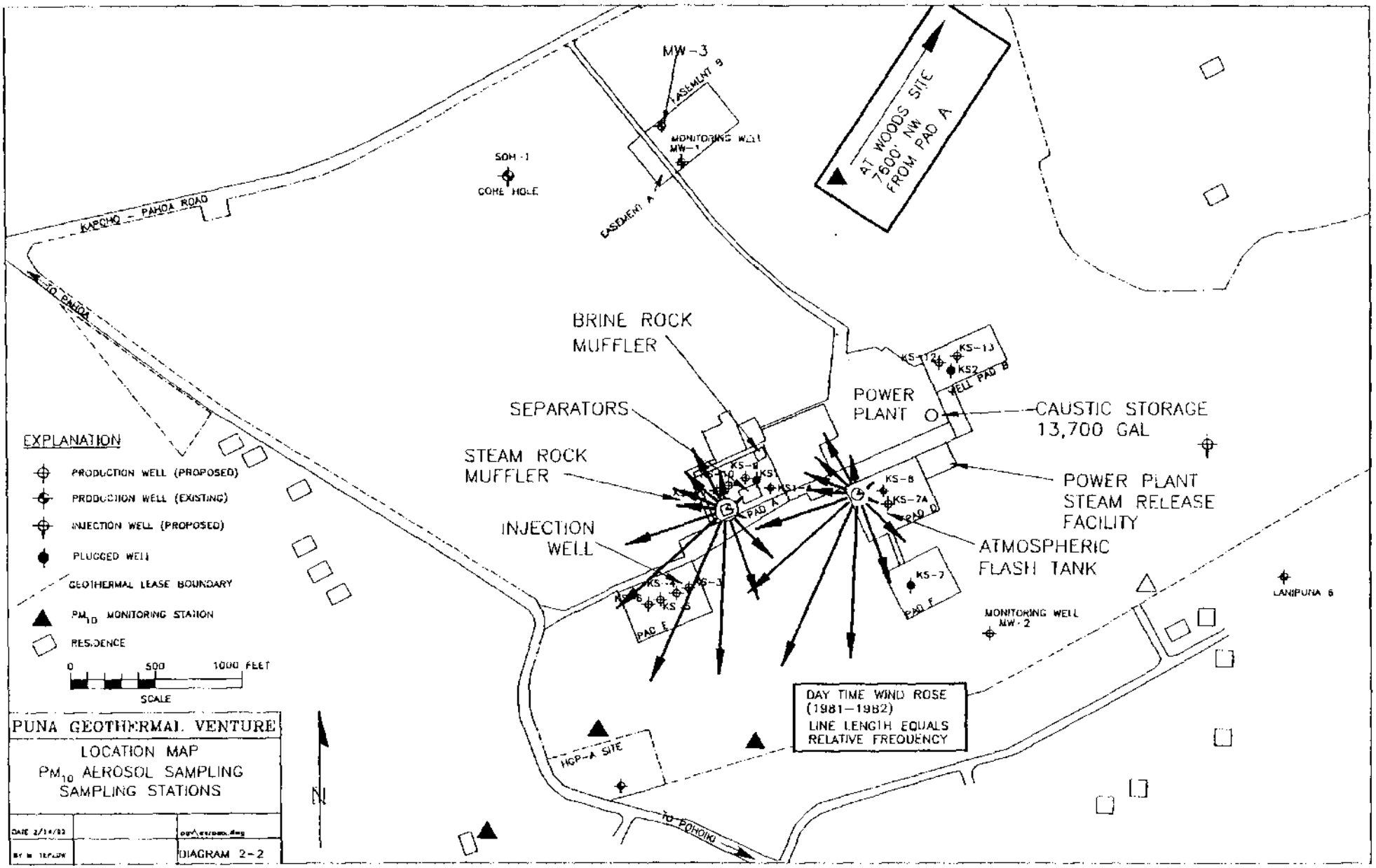
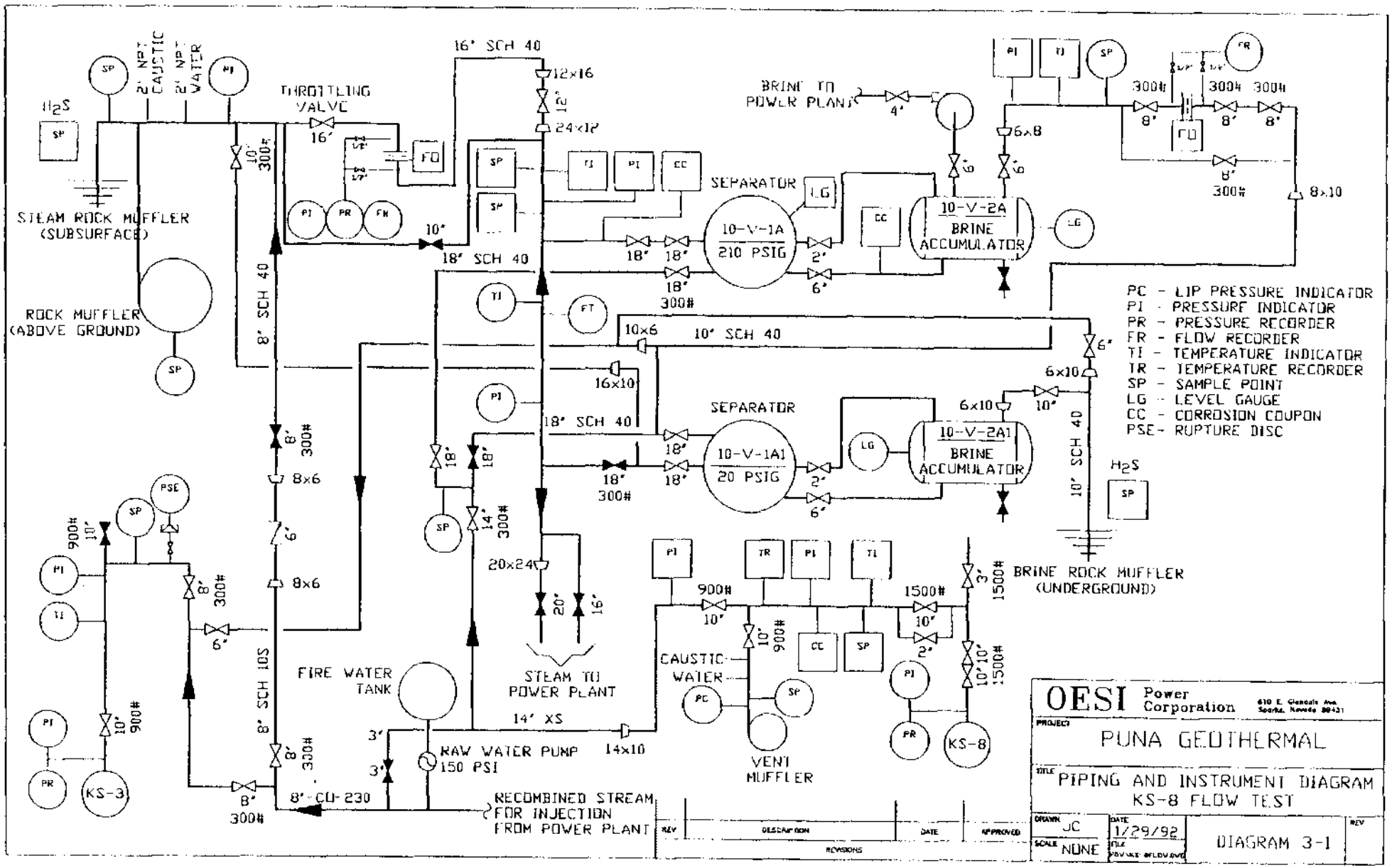
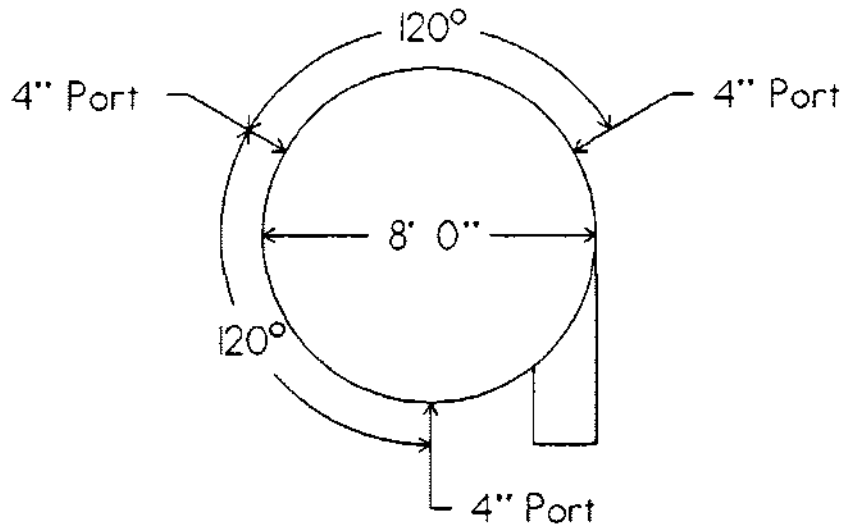


Diagram 2-1
KS-8 Vent Muffler. Pad D


MW-3
EASEMENT B
MONITORING WELL MW-1
SOH-1
CORE HOLE
EASEMENT A
KAPOHO - PAHOA ROAD
TO PAHOA
AT WOODS SITE 7600' NW FROM PAD A
BRINE ROCK MUFFLER
SEPARATORS
STEAM ROCK MUFFLER
INJECTION WELL
POWER PLANT
CAUSTIC STORAGE 13,700 GAL
POWER PLANT STEAM RELEASE FACILITY
ATMOSPHERIC FLASH TANK
KS-12
KS-13
KS2
WELL PAD B
KS-8
KS-7A
PAD D
KS-7
PAD F
KS-3
KS-5
KS-6
PAD E
MONITORING WELL MW-2
LANIPUNA 6
HGP-A SITE
TO POHOIKI
DAY TIME WIND ROSE (1981-1982)
LINE LENGTH EQUALS RELATIVE FREQUENCY
EXPLANATION
PRODUCTION WELL (PROPOSED)
PRODUCTION WELL (EXISTING)
INJECTION WELL (PROPOSED)
PLUGGED WELL
GEOTHERMAL LEASE BOUNDARY
PM10 MONITORING STATION
RESIDENCE
0 500 1000 FEET
SCALE
N
PUNA GEOTHERMAL VENTURE
LOCATION MAP
PM10 AEROSOL SAMPLING
SAMPLING STATIONS
DATE 2/14/83
DIAGRAM 2-2


H2S
2" NPT CAUSTIC
2" NPT WATER
THROTTLING VALVE
STEAM ROCK MUFFLER (SUBSURFACE)
ROCK MUFFLER (ABOVE GROUND)
16" SCH 40
12x16
24x12
10" 300#
8" SCH 40
10"
18" SCH 40
BRINE TO POWER PLANT
4"
SEPARATOR
10-V-1A
210 PSIG
10-V-2A
BRINE ACCUMULATOR
6x8
8" 300#
8x10
10x6
10" SCH 40
16x10
18" SCH 40
SEPARATOR
10-V-1A1
20 PSIG
10-V-2A1
BRINE ACCUMULATOR
6x10
10" SCH 40
BRINE ROCK MUFFLER (UNDERGROUND)
8x6
20x24
20"
16"
STEAM TO POWER PLANT
14" XS
14x10
FIRE WATER TANK
RAW WATER PUMP 150 PSI
8" SCH 10S
8" CD-230
RECOMBINED STREAM FOR INJECTION FROM POWER PLANT
CAUSTIC
WATER
VENT MUFFLER
KS-3
KS-8
900#
1500#
PC - LIP PRESSURE INDICATOR
PI - PRESSURE INDICATOR
PR - PRESSURE RECORDER
FR - FLOW RECORDER
TI - TEMPERATURE INDICATOR
TR - TEMPERATURE RECORDER
SP - SAMPLE POINT
LG - LEVEL GAUGE
CC - CORROSION COUPON
PSE - RUPTURE DISC
OESI Power Corporation
PROJECT PUNA GEOTHERMAL
TITLE PIPING AND INSTRUMENT DIAGRAM KS-8 FLOW TEST
DRAWN JC
DATE 1/29/92
SCALE NONE
DIAGRAM 3-1
REVISIONS
REV
DESCRIPTION
DATE
APPROVED



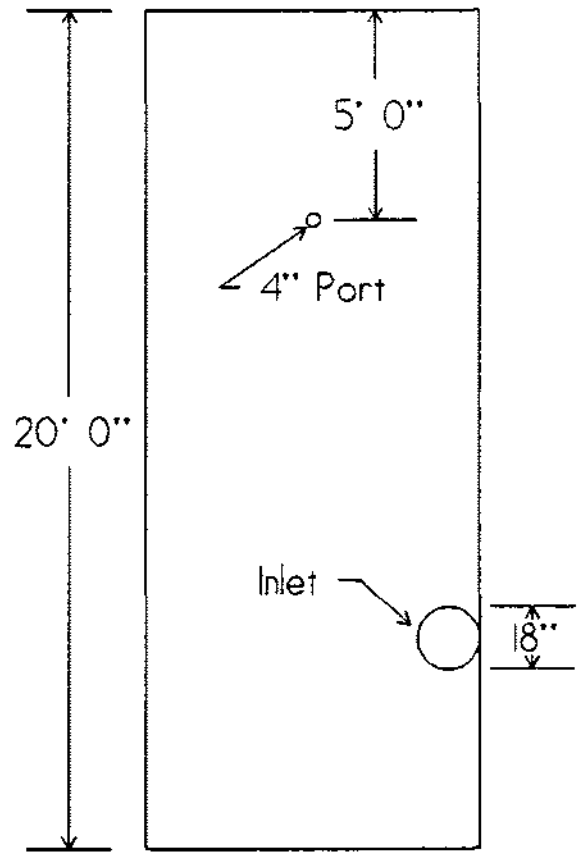


Diagram 3-2
Well Test Diversion Muffler. Pad A

FILE COPY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

May 28, 1991

91-A292
File #833

Mr. Maurice A. Richard
Regional Development Manager
Puna Geothermal Venture
101 Aupuni Street, Suite 1014-B
Hilo, Hawaii 96720

Dear Mr. Richard:

Subject: Modification to Authority to Construct No. A-833-795
Fourteen (14) Geothermal Exploratory/Development Wells
Located at TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19,
Kilauea Lower East Rift Zone, Puna, Hawaii

Pursuant to Chapter 342B, Hawaii Revised Statues, and Chapter 11-60, Hawaii Administrative Rules, the Department of Health (DOH) hereby modifies the subject Authority to Construct No. A-833-795.

The following modified special conditions supersede the corresponding special conditions of Attachment II issued with ATC No. A-833-795 dated February 6, 1990 and as modified on March 16, 1991:

Special Condition No. 17

No more than two (2) drilling rigs may be used simultaneously in the well drilling operations. The permittee shall utilize mud drilling techniques to the extent possible during the well drilling operations. In no case shall air drilling be used in the construction of the geothermal well. The drilling with aerated mud or aerated water may be used in lieu of mud drilling, but should be minimized to the extent practicable. Should any releases of steam occur during the drilling operations, the drilling fluid weight shall be immediately increased to stop the steam flow.

In no case shall the cumulative inadvertent steam releases from all simultaneous well drilling operations result in total hydrogen sulfide emissions of five (5.0) pounds per hour or more, or exceed a total of seven (7) minutes in duration in any one hour. During any period when two

drilling rigs are operating simultaneously, the operator of each rig shall immediately notify the other operator of any inadvertent steam release, the duration of the release, and the estimated hydrogen sulfide emissions. If the cumulative inadvertent steam releases from either or both well drilling operations result in total hydrogen sulfide emissions of five (5.0) pounds per hour or more, or exceeds a total of seven (7) minutes in duration in any one hour, the permittee shall take immediate action to shut-in the wells, and shall so notify the Department of Health.

Records of each steam release incident shall be maintained and include as a minimum, date, time and duration of the incident, the estimated resultant emissions, and the corrective measures taken. The records shall be in a permanent form suitable for inspection, shall be made available upon request by the Department of Health, and shall be retained for at least three (3) years following the date of such records.

Special Condition No. 21

The two (2) 860 HP diesel engine generators for rig no. 1 and the three (3) 877 HP diesel engines for rig no. 2 shall be fired only on fuel oil no. 2 with a maximum sulfur content not to exceed 0.5 percent by weight. For rig no. 2, only two (2) of the three (3) 877 HP diesel engines may be operated at any given time, and in no case shall all three (3) 877 HP diesel engines be operated simultaneously.

On a twelve (12) month rolling average, the total combined fuel usage of all five (5) diesel engines shall not exceed 275,124 gallons.

Prior to the startup of rig no. 2, the permittee shall install non-resetting fuel metering systems for the permanent recording of the total gallons of fuel consumed by each of the five (5) diesel engines associated with both rigs no. 1 and no. 2. The permittee shall maintain records on a monthly basis on the total amount of fuel oil consumed by each diesel engine. In addition, records shall be maintained on the total amount of fuel oil consumed by the associated diesel engines for the drilling of each well. Both records shall be submitted to the Department of Health at the completion of each well.

Prior to the startup of rig no. 2, the permittee shall retard the fuel injection timing of each of the three (3) diesel engines servicing rig no. 2 six (6) degrees from the manufacturer's recommended standard injection timing setting. The permittee shall maintain the level of injection timing retard at all times during operation of the engines through a regular program of inspection and maintenance. Upon completion of the setting of the fuel injection timing retard of six (6) degrees, the permittee shall submit to the Department of Health a copy of the work order and documentation certifying the fuel injection timing of each of the three (3) diesel engines.

All other special conditions of Attachment II issued with ATC No. A-833-795 dated February 6, 1990 and as modified on March 16, 1991 shall not be affected and shall remain valid.

These modifications shall become final twenty (20) days after receipt, unless before the twenty (20) days expire, Puna Geothermal Venture submits a written request to the Director of Health for

a hearing pursuant to Chapters 91 and 342B, Hawaii Revised Statutes. If a hearing is requested, it will be held at a date, time, and place to be specified later and conducted in accordance with Chapter 91, Hawaii Revised Statutes, and the rules of Practice and Procedure of the Department of Health.

Very truly yours,

FOR JOHN C. LEWIN, M.D.
Director of Health

NH/sk
c: DHSA, Hawaii
Manabu Tagamori, DLNR
Rodney Nakano, Hawaii County Planning Department
Michelle Wong-Wilson, DBEDT

FILE COPY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

March 16, 1990

90-A99
File #833

Mr. Maurice A. Richard
Regional Development Manager
Puna Geothermal Venture
101 Aupuni Street, Suite 1014-B
Hilo, Hawaii 96720

Dear Mr. Richard:

Subject: Modification to Authority to Construct No. A-833-795
Fourteen (14) Geothermal Exploratory/Development Wells
Located at TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19,
Kilauea Lower East Rift Zone, Puna, Hawaii

Pursuant to Chapter 342B, Hawaii Revised Statutes, and Chapter 11-60, Hawaii Administrative Rules, the Department of Health (DOH) hereby modifies the subject Authority to Construct No. A-833-795.

The following modified special conditions supersede the corresponding special conditions of Attachment II issued with ATC No. A-833-795 dated February 6, 1990:

Special Condition No. 2

This Authority to Construct is for fourteen (14) geothermal exploratory/developmental wells to be drilled in TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19, Kilauea Lower East Rift Zone, Puna, Hawaii. Written notification must be submitted to and approval obtained from the Department of Health prior to the commencement of construction of each well. The Department of Health shall act on the approval in a timely manner provided all required and requested information have been submitted. Each notification shall include a drawing identifying the well location, the property boundary, access roads approaching and traversing the property, the location of the nearest residence, and the locations of the air quality monitoring stations. The status of all previous constructed wells shall be provided including a clear description of the measures taken to shut-in the well. Additional information may be requested of the permittee.

Special Condition No. 3

The permittee shall obtain a Permit to Operate prior to any well approved under this permit being connected to and becoming a part of a distribution system which supplies geothermal resource to a power plant or facility. Additional permit conditions may be included in the Permit to Operate.

Special Condition No. 5

The permittee shall install, operate, and maintain a minimum of one (1) meteorological and three (3) air quality monitoring stations. The monitoring stations required in any permit for the 25 MW power plant may be used towards fulfilling this requirement.

Prior to the commencement of construction of each of the fourteen (14) wells, the permittee shall submit for the Department of Health's approval the siting of the air quality and meteorological monitoring stations. The air quality and meteorological monitoring stations shall be fully operational prior to the commencement of drilling operations. The permittee shall maintain a file of all measurements, including the monitoring system performance evaluations; calibration checks; and adjustments and maintenance performed on the system or devices. The measured data shall meet U.S. EPA capture requirements and quality assurance guidelines. At a minimum, a quality assurance check shall be conducted on each monitoring station every-other-day.

The air quality monitors shall be equipped with an alarm system or an acceptable equivalent system that will immediately notify the permittee of ambient hydrogen sulfide concentrations in excess of 25 ppb (above background) and 100 ppb (including background) on a one-hour average. The permittee shall immediately notify the Department of Health and the Hilo District Health Office of any exceedance above 25 ppb (above background) and 100 ppb (including background) on a one-hour average.

Two (2) copies of the data file in a format acceptable to the Department of Health shall be submitted on an annual basis. The data file shall be in a format that can be utilized by a personal computer for ready extraction of data. The air quality and meteorological data shall be summarized and submitted monthly in writing to the Department of Health. Additional information on the monitoring stations and on the data collected shall be submitted upon request by the Department of Health.

Special Condition No. 9

Flaring of excess hydrogen sulfide gas from the completed wells is prohibited without the approval of the Department of Health. If flaring of the excess gas is considered necessary, the permittee must submit a written request to the Department of Health which shall include as a minimum the proposed date, time and approximate duration of the flaring episode, the current and expected well head pressure, the estimated hydrogen sulfide concentration in the well gas, the estimated emission rates for hydrogen sulfide and sulfur dioxide, an air quality impact analysis for sulfur dioxide, the probable cause of excess gas buildup, and an assessment of any abatement alternatives.

If a request to flare excess gas is approved as necessary by the Department of Health, the approval may be subject to specified conditions. These conditions may include, but are not limited to, provisions requiring the permittee to install, operate, and maintain sulfur dioxide ambient monitors and to submit to the Department of Health after the flaring event a report on the times flaring actually occurred, the sulfur dioxide emissions determined through either direct or indirect measurements, and any problems encountered during the flaring process.

Special Condition No. 11

The permittee shall have proper safety devices on-site at least three days prior to commencement of drilling operations. A minimum of three breathing apparati shall be available at the site and maintained by a qualified person/contractor. Wind socks shall be placed at two opposite edges of the drill site and on the drill floor. At least one person with certified hydrogen sulfide training to respond to hydrogen sulfide emergency episodes shall be on-site at all times.

Special Condition No. 13

The permittee shall monitor the hydrogen sulfide concentration and emission rate continuously in the steam by use of an electrochemical type sensor and recorder during the flow testing operations. If the abated hydrogen sulfide emission rate increases to five (5.0) pounds per hour or more, the permittee shall cease operations and shut-in the well. The Department of Health shall be so notified and the problem corrected before testing operations can continue.

During periods of well equipment failure or malfunction which result in hydrogen sulfide emissions, the permittee shall apply best available control technology for the air emissions and take immediate steps to correct the condition. The Department of Health shall be immediately notified of the well equipment failure or malfunction. If the well equipment in question cannot be repaired within twenty-four (24) hours of the occurrence or the hydrogen sulfide ambient

concentration exceeds the specified limits in Special Condition Nos. 23, 27 and 28, the permittee shall cease operations and shut-in the well in accordance with Special Condition Nos. 23, 27 and 28. Within five (5) days of the occurrence, a report shall be submitted to the Department of Health. The report shall include a description of the equipment failure or malfunction, the date of the initial failure, the estimated resultant emissions, time and duration of the event, and the repairs conducted to restore normal operations. Compliance with this notification provision shall not excuse or otherwise constitute a defense for any violation(s) of this permit, law, rule, or order which results from the well equipment failure or malfunction.

Special Condition No. 17

The permittee shall utilize mud drilling techniques to the extent possible during the well drilling operations. In no case shall air drilling be used in the construction of the geothermal well. The drilling with aerated mud or aerated water may be used in lieu of mud drilling, but should be minimized to the extent practicable. Should any releases of steam occur during the drilling operations, the drilling fluid weight shall be immediately increased to stop the steam flow. In no case shall any inadvertent steam releases result in hydrogen sulfide emissions of five (5.0) pounds per hour or more, or exceed seven (7) minutes in duration in any one hour. If the inadvertent steam releases cannot be controlled by increasing the fluid weight or exceeds seven (7) minutes in duration in any one hour, the permittee shall take immediate action to shut-in the well.

Records of each steam release incident shall be maintained and include as a minimum, date, time and duration of the incident, the estimated resultant emissions, and any corrective measures taken. The records shall be in a permanent form suitable for inspection, shall be made available upon request by the Department of Health, and shall be retained for at least three (3) years following the date of such records.

Special Condition No. 22

Unabated well venting shall be allowed only after the permittee has checked with the National Weather Service and is assured of meteorological conditions appropriate for optimal dispersion and minimal air quality impact. In no case shall the well venting commence if the average wind speed at the well site is less than 4 meters per second (8.9 miles per hour). Prior to well venting, the Department must be informed in writing a minimum of two (2) days prior to commencement and so concur. The public shall be notified a minimum of 24-hours in advance by notices in the newspapers of general circulation in Hawaii County. In addition, the permittee shall make a reasonable effort to notify all residents living within 3,500 feet of the permittee's property boundary a minimum

of 24-hours in advance of open venting of each well and pipeline cleanout. In preparation for flow testing, each well shall be allowed to open vent only during the daytime and no more than a total of four (4) hours.

In no case shall any well venting coincide with any pipeline cleanouts, or well flow testing operations, or commence if the power plant emergency steam release facility is being utilized. If emergency steam releases from the power plant occur during the venting of any well, venting of that well shall be terminated as quickly as practical.

Special Condition No. 23

In no case shall the well drilling, flow testing, venting operations, or well equipment failure or malfunction of any of the fourteen (14) geothermal exploratory/developmental wells cause or contribute to an exceedance of the hydrogen sulfide ambient level of 100 ppb (including background) on a one-hour average at or beyond the project boundary. Should any of the approved air quality monitoring stations indicate a hydrogen sulfide ambient concentration greater than 100 ppb (including background) on a one-hour average, the permittee shall immediately notify the Department of Health, ceasing all well drilling with aerated mud or aerated water, well flow testing, and well venting operations, and shutting in those wells experiencing equipment failure or malfunction, which result in emissions of hydrogen sulfide. The affected wellfield construction activities shall be allowed to proceed only after the permittee has satisfactorily demonstrated to the Department of Health that the contributions from the well drilling with aerated mud or aerated water, well flow testing, well venting operations or well equipment repair will not result in or contribute to the exceedance of the hydrogen sulfide ambient concentration of 100 ppb (including background) on a one-hour average.

The permittee shall submit to the Department of Health a written follow-up report within five (5) days of the occurrence. The report shall include the date, time and duration of the exceedance(s), the status of all project operations during the exceedance, the estimated project emissions and any other emission sources that may have contributed to the exceedance, and all corrective measures and actions to reduce project emissions to a minimum. Compliance with this notification provision shall not excuse or otherwise constitute a defense to any violation(s) of this permit or of any law or regulations.

Special Condition No. 27

During those periods of normal power plant and normal wellfield operations, the combined emissions of hydrogen sulfide from the 25 MW geothermal power plant (A-834) and associated wellfield (A-833) shall not cause an increase in the

hydrogen sulfide ambient concentration in excess of 5 ppb (above background) on a one-hour average at or beyond the project boundary as monitored at any of the approved air quality monitoring stations and so identified in the monthly monitoring report. As used in this context, a normal power plant operation is a power plant which is operating without any upsets, equipment failure, malfunction or which is otherwise operating normally. A normal wellfield operation is a wellfield in which no well drilling, flow testing, or venting activities are occurring and where the completed wells are not experiencing any equipment failure or malfunction and are either shut-in, being used as an injection well, or connected to a sound geothermal resource distribution system.

Special Condition No. 28

Excluding periods of well venting and pipeline cleanout, the combined emissions of hydrogen sulfide from the 25 MW geothermal power plant (A-834) and associated wellfield (A-833) shall not cause an increase in the hydrogen sulfide ambient concentration in excess of 25 ppb (above background) on a one-hour average at or beyond the project boundary as monitored at any of the approved air quality monitoring stations and so identified in the monthly monitoring report.

Should any of the approved air quality monitoring stations indicate a hydrogen sulfide ambient concentration greater than 25 ppb (above background) on a one-hour average, the permittee shall immediately notify the Department of Health and the Hilo District Health Office and shall cease all geothermal well drilling with aerated mud or aerated water, well flow testing, and scheduled project maintenance, and shut-in those wells experiencing equipment failure or malfunction, which result in emissions of hydrogen sulfide. The affected well drilling, flow testing, scheduled maintenance, and well equipment repair shall be allowed to proceed only after the permittee has satisfactorily demonstrated to the Department of Health that the hydrogen sulfide emissions from the affected well drilling, flow testing, scheduled maintenance, well equipment or power plant repairs, power plant emergency steam release, or normal power plant operation, whether separately or in any combination, did not or will not cause an increase in the hydrogen sulfide ambient concentration in excess of 25 ppb (above background) on a one-hour average.

The following special condition of Attachment II issued with ATC No. A-833-795 dated February 6, 1990 is hereby deleted:

Special Condition No. 24

The drilling, flow testing, and venting operations of any of the fourteen (14) geothermal exploratory/developmental wells shall not cause or contribute to an

exceedance of the hydrogen sulfide ambient level of 100 ppb on a one-hour average at or beyond the project boundary.

All other special conditions of Attachment II (Special Condition Nos. 1, 4, 6, 7, 8, 10, 12, 14, 15, 16, 18, 19, 20, 21, 25 and 26) issued with ATC No. A-833-795 dated February 6, 1990 shall not be affected and shall remain valid.

These modifications shall become final twenty (20) days after receipt, unless before the twenty (20) days expire, Puna Geothermal Venture submits a written request to the Director of Health for a hearing pursuant to Chapters 91 and 342B, Hawaii Revised Statutes. If a hearing is requested, it will be held at a date, time, and place to be specified later and conducted in accordance with Chapter 91, Hawaii Revised Statutes, and the rules of Practice and Procedure of the Department of Health.

Very truly yours,

JOHN C. LEWIN, M.D.
Director of Health

WN/sk
cc: DHSA, Hawaii

FILE COPY

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

February 6, 1990

90-A52
File #833

Mr. Maurice A. Richard
Regional Development Manager
Puna Geothermal Venture
101 Aupuni Street, Suite 1014-B
Hilo, Hawaii 96720

Dear Mr. Richard:

Subject: Authority to Construct (ATC) No. A-833-795
Application for ATC No. A-833
Expiration Date: February 1, 1992

An Authority to Construct in accordance with Administrative Rules, Title 11, Chapter 60, is hereby issued to **Puna Geothermal Venture for Fourteen (14) Geothermal Exploratory/ Developmental Wells located at TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19, Kilauea Lower East Rift Zone, Puna, Hawaii.** The issuance of this permit is based on the plans, specifications, and additional information that you submitted as part of your application dated March 24, 1989 and the subsequent information submitted on June 9, 1989.

Although the Authority to Construct application is for the construction of 30 geothermal wells over the life of the project, the subject Authority to Construct permit authorizes the construction of only 14 geothermal wells which have been deemed necessary to initially supply and support the power plant operating at maximum capacity. Authority to Construct application(s) for additional geothermal wells should be submitted as the needs are identified.

The Authority to Construct is issued subject to the conditions set forth in Attachments I and II.

Also enclosed is Form AS-P-3, Application for Permit to Operate a Facility. Please submit this application with the applicable filing fee sixty (60) days prior to each well being connected and becoming a part of a distribution system which supplies geothermal resource to a power plant or facility. In addition, you must submit to the Department in writing the notification of completion of construction. The Authority to Construct must remain in effect until the Permit to Operate is granted or denied for the fourteen (14) geothermal exploratory/ developmental wells.

Very truly yours,

JOHN C. LEWIN, M.D.
Director of Health

NH/sk
Enclosures
cc: DHSA, Hawaii

ATTACHMENT I. STANDARD CONDITIONS OF AUTHORITY TO CONSTRUCT, NO. A-833-795
APPLICATION NO. A-833
WELLFIELD

This permit is granted in accordance with the State of Hawaii Administrative Rules, Title 11, Chapter 60, Air Pollution Control, and is subject to the following standard conditions:

1. This permit is non-transferable from person to person, from place to place, or from one piece of equipment to another.

2. This permit is automatically void if construction has not begun within one year of the date of issuance or if the work involved is suspended for one year or more.

3. This permit is automatically void when the Permit to Operate is issued or denied for all fourteen (14) exploratory/developmental wells.

4. The facility covered by this permit shall be constructed as specified in the application for Authority to Construct. There shall be no deviation unless additional or revised plans are submitted to and approved by the Department.

5. This permit is not a guarantee that the facility will receive a Permit to Operate at the end of the construction period, nor does it absolve the holder from the responsibility for the consequences of non-compliance with all Rules, Regulations, and Orders of the Department.

6. This authority, (a) shall not in any manner affect the title of the premises upon which the equipment is to be located, (b) does not release the permittee from any liability for any loss due to personal injury or property damage caused by, resulting from or arising out of the design, installation, maintenance, or operation of the proposed equipment, (c) does not release the permittee from compliance with other applicable statutes of the State of Hawaii, or with applicable local laws, regulations, or ordinances, and (d) in no manner implies or suggests that the Department, or its officers, agents, or employees, assumes any liability, directly or indirectly, for any loss due to personal injury or property damage caused by, resulting from or arising out of the design, installation, maintenance, or operation of the proposed equipment.

7. The Department is to be notified promptly in writing upon completion of the construction or installation of any equipment for which an Authority to Construct has been issued.

ATTACHMENT II. SPECIAL CONDITIONS OF AUTHORITY TO CONSTRUCT, NO. A-833-795
APPLICATION NO. A-833
WELLFIELD

In addition to the standard conditions of the Authority to Construct, this permit is subject to the following special conditions:

1. The permit conditions prescribed herein may at any time be revised by the Department of Health to conform to any Federal or State promulgated air quality rules on geothermal facilities.

2. This Authority to Construct is for fourteen (14) geothermal exploratory/developmental wells to be drilled in TMK: 1-4-01:2, 1-4-01:3, 1-4-01:58 and 1-4-01:19, Kilauea Lower East Rift Zone, Puna, Hawaii. Written notification must be submitted to and approval obtained with minimal delay from the Department of Health prior to commencement of construction of each well. Each notification shall include a drawing identifying the well location, the property boundary, access roads approaching and traversing the property, the location of the nearest residence, and the locations of the air quality monitoring stations. The status of all previous constructed wells shall be provided including a clear description of the measures taken to shut-in the well. Additional information may be requested of the permittee.

3. The Department of Health shall act on a Permit to Operate Application prior to any well approved under this permit being connected and becoming a part of a distribution system which supplies geothermal resource to a power plant or facility. Additional permit conditions may be included in the Permit to Operate.

4. No geothermal exploratory/developmental wells shall be located within 600 feet of the property boundary. If any federal, state or county permit or order stipulates a distance greater than 600 feet in which no geothermal wells can be located, the greater distance shall so apply.

5. The permittee shall install, operate, and maintain a minimum of one (1) meteorological and three (3) air quality monitoring stations. The monitoring stations required in any permit for the 25 MW power plant may be used towards fulfilling this requirement.

   Prior to the commencement of construction of each of the fourteen (14) wells, the permittee shall submit for the Department of Health's approval the siting of the air quality and meteorological monitoring stations. The air quality and meteorological monitoring stations shall be fully operational prior to the commencement of drilling operations. The permittee shall maintain a file of all measurements, including the monitoring system performance evaluations; calibration checks; and adjustments and maintenance performed on the system or devices. The measured data shall meet U.S. EPA capture requirements and quality assurance guidelines. At a minimum, a quality assurance check shall be conducted on each monitoring station every-other-day.

   The air quality monitors shall be equipped with an alarm system or an acceptable equivalent system that will immediately notify the permittee of ambient hydrogen sulfide concentrations in excess of 25 ppb and 100 ppb on a one-hour average. The permittee shall immediately notify the Department of Health and the Hilo District Health Office of any exceedance above 100 ppb.

Two (2) copies of the data file in a format acceptable to the Department of Health shall be submitted on an annual basis. The data file shall be in a format that can be utilized by a personal computer for ready extraction of data. The air quality and meteorological data shall be summarized and submitted monthly in writing to the Department of Health. Additional information on the monitoring stations and on the data collected shall be submitted upon request by the Department of Health.

6. At the discretion of the Director of Health, the permittee may at any time be required to install, operate, and maintain additional air quality and meteorological monitoring stations, but only after due notice to the permittee on the reasons for the proposed change and providing the permittee an opportunity to respond within seven (7) days.

7. The permittee shall notify the Department of Health in writing at least two (2) working days prior to the commencement, and within two (2) working days after the completion of the aerated mud or aerated water drilling, well venting, and flow testing operations, for each geothermal well.

8. Upon completion of flow testing operations, each geothermal well shall be shut-in or otherwise prevented from discharging to the atmosphere in accordance with appropriate standards of operation and maintenance and at no time be placed on continuous or standby bleed status.

9. Occasional flaring of excess hydrogen sulfide gas from the completed wells is prohibited unless such flaring is necessary to insure well integrity or safety and is conducted in such a manner that no state or national ambient air quality standards for sulfur dioxide are exceeded. Records shall be maintained on all flaring episodes, and shall include, as a minimum, the date, time and duration of the event, probable causes of the excess gas buildup, and the estimated emissions of sulfur dioxides determined through either direct or indirect measurements. The records shall be in a permanent form suitable for inspection and shall be retained for at least three (3) years following the date of such records. The permittee shall submit a written report monthly to the Department of Health on the flaring episodes which demonstrates compliance with the requirements of this condition. If flaring occurs frequently or routinely, the permittee shall install, operate, and maintain ambient sulfur dioxide monitors at each air quality monitoring station and comply with all recordkeeping requirements in accordance with Special Condition No. 5.

10. All access roads into the property shall be limited to authorized personnel only. Twenty-four hour staffing shall be in place during construction.

11. The permittee shall have proper safety devices on-site at least three days prior to commencement of air drilling. A minimum of three breathing apparati shall be available at the site and maintained by a qualified person/contractor. Wind socks shall be placed at two opposite edges of the drill site and on the drill floor. At least one person with certified hydrogen sulfide training to respond to hydrogen sulfide emergency episodes shall be on-site at all times.

12. Hydrogen sulfide abatement equipment with a minimum of 3,000 gallons of sodium hydroxide shall be on the property prior to the initiation of flow testing operations.

Chemical storage tanks shall be maintained with sodium hydroxide at all times with no less than a three-day operating supply.

13. The permittee shall monitor the hydrogen sulfide concentration and emission rate continuously in the steam by use of an electrochemical type sensor and recorder during the flow testing operations. If the abated hydrogen sulfide emission rate increases to five (5.0) pounds per hour or more, the permittee shall cease operations and shut-in the well. The Department of Health shall be so notified and the problem corrected before testing operations can continue.

    During periods of equipment failure or malfunction which result in hydrogen sulfide emissions, the permittee shall apply best available control technology for the air emissions and shall so notify the Department of Health within one (1) hour of the occurrence. The permittee shall immediately take steps to correct the condition. If repairs cannot be accomplished within twenty-four (24) hours of the occurrence, the permittee shall cease operations and shut-in the well. Within five (5) days of the occurrence, a report shall be submitted to the Department of Health in accordance with Hawaii Administrative Rules, Section 11-60-14.

14. Wet chemical tests for the determination of the hydrogen sulfide concentrations shall be conducted and recorded on a daily basis during all phases of the flow testing operations.

15. The following data shall be recorded during the flow testing operations:

    a. At least four times per 24-hour period, hydrogen sulfide ppm upstream from the injection system.

    b. At least four times per 24-hour period, injection rate of sodium hydroxide.

    c. At least four times per 24-hour period, hydrogen sulfide emission rate (lbs/hr) and concentration (ppm) downstream, after chemical injection.

    d. Daily, zero and span check of hydrogen sulfide sensor.

    e. Weekly, calibration check of hydrogen sulfide sensor.

    f. Daily, the quantity of sodium hydroxide remaining in the abatement equipment storage tanks.

    Additional entries will be made when significant changes in the resource occurs and when changes are made in injection rates of sodium hydroxide.

    The aforementioned daily records a., b., and c. shall also be reported daily to the Department of Health by telephone no later than noon of the following work day. The Department of Health may at any time request additional data or revise the frequency of this daily telephone reporting requirement.

    The records shall be kept at the well location at all times during the drilling and flow testing operations and shall be made available upon request by the Department of Health

or its duly authorized representative. Copies or summaries of the records shall be provided within a reasonable time upon request by the Department of Health. The records shall be retained for at least three years following the date of such records.

16. The permittee shall maintain a 24-hour telephone service to accept calls concerning this Authority to Construct. This telephone number must be operational prior to commencement of construction.

17. The permittee shall utilize mud drilling techniques to the extent possible during the well drilling operations. In no case shall air drilling be used in the construction of the geothermal well. The drilling with aerated mud or aerated water may be used in lieu of mud drilling, but should be minimized to the extent practical. Should any inadvertent releases of steam occur during the drilling operations, the drilling fluid weight shall be immediately increased to stop the steam flow. In no case shall any inadvertent steam releases exceed seven (7) minutes in duration in any one hour. If the inadvertent steam releases cannot be controlled by increasing the fluid weight or exceeds seven (7) minutes in duration, the permittee shall take immediate action to shut-in the well.

    Records of each steam release incident shall be maintained and include as a minimum, date, time and duration of the incident, the estimated resultant emissions, and any corrective measures taken. The records shall be in a permanent form suitable for inspection, shall be made available upon request by the Department of Health, and shall be retained for at least three (3) years following the date of such records.

18. Steam production rates and hydrogen sulfide concentrations shall be measured to determine hydrogen sulfide emissions in pounds per hour. A sodium hydroxide treatment mole ratio of 4 to 1 (NaOH/H2S) will be used initially and the abatement efficiency monitored. The optimum mole ratios will be determined during the hydrogen sulfide abatement operations. A specific chemical treatment plan shall be submitted to the Department of Health prior to the commencement of flow testing. A copy of the plan shall be maintained at the site at all times and supervisory personnel shall be aware of its provisions at all times.

19. The permittee shall promptly notify the Department of Health should any toxic emissions be encountered of public health concern and where dispersion into the ambient air was the mitigative action.

20. The permittee shall perform once on each well, testing and analyses for all of the following constituents of the steam condensate, steam, particulates and/or gases emanating from each well:

STEAM CONDENSATE/TOTAL STEAM	GAS PHASE
Benzene	Benzene
Ammonium (Total)	Hydrogen Sulfide
Arsenic	Ammonia
Lead	Radon 222 and daughters
Cadmium	Mercury Vapor
Bicarbonate and Carbonate	Methane
Sulfates	

STEAM CONDENSATE/TOTAL STEAM	GAS PHASE
Chlorides	Non-Methane Hydro-carbons
Nitrates	Carbon dioxide
Boron (Total)	Sulfur dioxide
Hydrogen Sulfide (Total)	NESHAPS - pollutants as requested
Fluorides (Total)	
Total Sulfur	
Mercury (Total)	
pH	
Total Dissolved Solids	
Total Suspended Solids	
Percent Noncondensibles	

21. The drilling rig diesel engine generators and pumps shall be fired only on diesel fuel oil no. 2 with a maximum sulfur content not to exceed 0.5 percent by weight. The permittee shall maintain records on the total amount of fuel oil consumed by all the diesel engines for the drilling of each well. The total gallons of fuel oil consumed shall be submitted to the Department of Health at the completion of each well.

22. Unabated well venting shall be allowed only after the permittee has checked with the National Weather Service and is assured of meteorological conditions appropriate for good dispersion and minimal air quality impact. In no case shall the well venting commence if the average wind speed at the well site is less than 4 meters per second. Prior to well venting, the Department must be informed in writing a minimum of two (2) days prior to commencement and so concur. The public shall be notified a minimum of 24-hours in advance by notices in the newspapers of general circulation in Hawaii County. In addition, the permittee shall make a reasonable effort to notify all residents living within 3,500 feet of the permittee's property boundary a minimum of 24-hours in advance of open venting of each well and pipeline cleanout. In preparation for flow testing, each well shall be allowed to open vent only during the daytime and no more than a total of four (4) hours.

    In no case shall any well venting coincide with any pipeline cleanouts or well flow testing operations, or commence if the power plant emergency steam release facility is being utilized. If emergency steam releases from the power plant occur during the venting of any well, venting of that well shall be terminated as quickly as practical.

23. Should any of the air quality monitoring stations indicate an ambient hydrogen sulfide, one-hour average concentration greater than 100 ppb, the permittee shall take immediate action to the extent practical to reduce all wellfield emissions. Within four (4) hours of the exceedance, the permittee shall reduce all wellfield hydrogen sulfide emissions associated with wellfield construction operations, including but not limited to drilling, flow testing, venting, etc., by a minimum of 50 percent of the level during the event. Following the reduction in project emissions, if the monitoring stations still indicate ambient hydrogen sulfide concentrations in excess of 100 ppb (one-hour average), the permittee shall cease all drilling operations and shut-in all wells under construction, unless the permittee can conclusively show to the Department of Health that the project operations and emissions

are not contributing any impact to monitoring site. If the project emissions have been reduced, the permittee shall maintain the emissions at this reduced level until such time the Department of Health is assured that the resumption of full activity shall not result in another exceedance of the ambient level of 100 ppb (one-hour average).

The permittee shall submit to the Department of Health a written follow-up report within two (2) days of the occurrence. The report shall include the date, time and duration of the exceedance(s), the status of all project operations during the exceedance, the estimated project emissions and any other emission sources that may have contributed to the exceedance, and all corrective measures and actions to reduce project emissions to a minimum. Compliance with this notification provision shall not excuse or otherwise constitute a defense to any violation(s) of this permit or of any law or regulations.

24. The drilling, flow testing, and venting operations of any of the fourteen (14) geothermal exploratory/developmental wells shall not cause or contribute to an exceedance of the hydrogen sulfide ambient level of 100 ppb on a one-hour average at or beyond the project boundary.

25. The permittee may be required to install a control system acceptable to the Department of Health for the rapid throttling of steam flow and well shut-in on each developmental well prior to the well being connected to a resource distribution system. The requirement for a control system may be so specified in the subsequent Permit to Operate.

26. To prevent well blowouts, the permittee shall employ good drilling practices with proper blowout prevention equipment and experienced personnel in the drilling of the exploratory/developmental wells. Drilling supervisors shall be certified in blowout prevention at a minimum of once every two years by a recognized training center. In the unlikely event of a well blowout, the permittee shall immediately proceed with measures to kill or gain control of the well and notify the Department of Health.

    The permittee shall submit to the Department of Health a written report within five (5) days of the blowout. The report shall include, as a minimum, the probable cause of the blowout, the actions that have or will be taken, the estimated time before the well is controlled, an analysis of the air quality impact from the unabated emissions, and a monitoring plan to determine the actual air quality impact resulting from the blowout. A status report shall be submitted to the Department of Health on a weekly basis until such time the control of the well is established.

27. During those periods of normal power plant and wellfield operation, the combined emissions of hydrogen sulfide from the 25 MW geothermal power plant and associated wellfield shall not cause an increase in the ambient hydrogen sulfide concentration in excess of 5 ppb (one-hour average) above background at or beyond the project boundary. During those periods when geothermal well drilling, well flow testing, or emergency steam release may be occurring, whether separately, in any combination, or whether in combination with periods of normal power plant or wellfield operation, the combined emissions of hydrogen sulfide from these sources shall not cause an increase in the ambient hydrogen sulfide concentration in excess of 25 ppb (one-hour average) above background at or beyond the project boundary.

28. For any ambient hydrogen sulfide concentration in excess of 5 ppb (one-hour average) above background as indicated by any air quality monitoring station, the permittee has the burden of proving that operation of the 25 MW geothermal power plant and wellfield did not cause the hydrogen sulfide impact in excess of 5 ppb (one-hour average), or proving that the power plant or wellfield had experienced an operational upset, equipment failure, malfunction or was otherwise not operating normally. For any ambient hydrogen sulfide concentration in excess of 25 ppb (one-hour average) above background as indicated by any air quality monitoring station, the permittee has the burden of proving that operation of the 25 MW geothermal power plant and wellfield did not cause the hydrogen sulfide concentration in excess of 25 ppb (one-hour average), or proving that the measured impact occurred during the vertical venting of a geothermal well or cleanout of the steam production pipelines.